The Electrical Industry's Weekly Magazine

September 30, 1957

Electrical World

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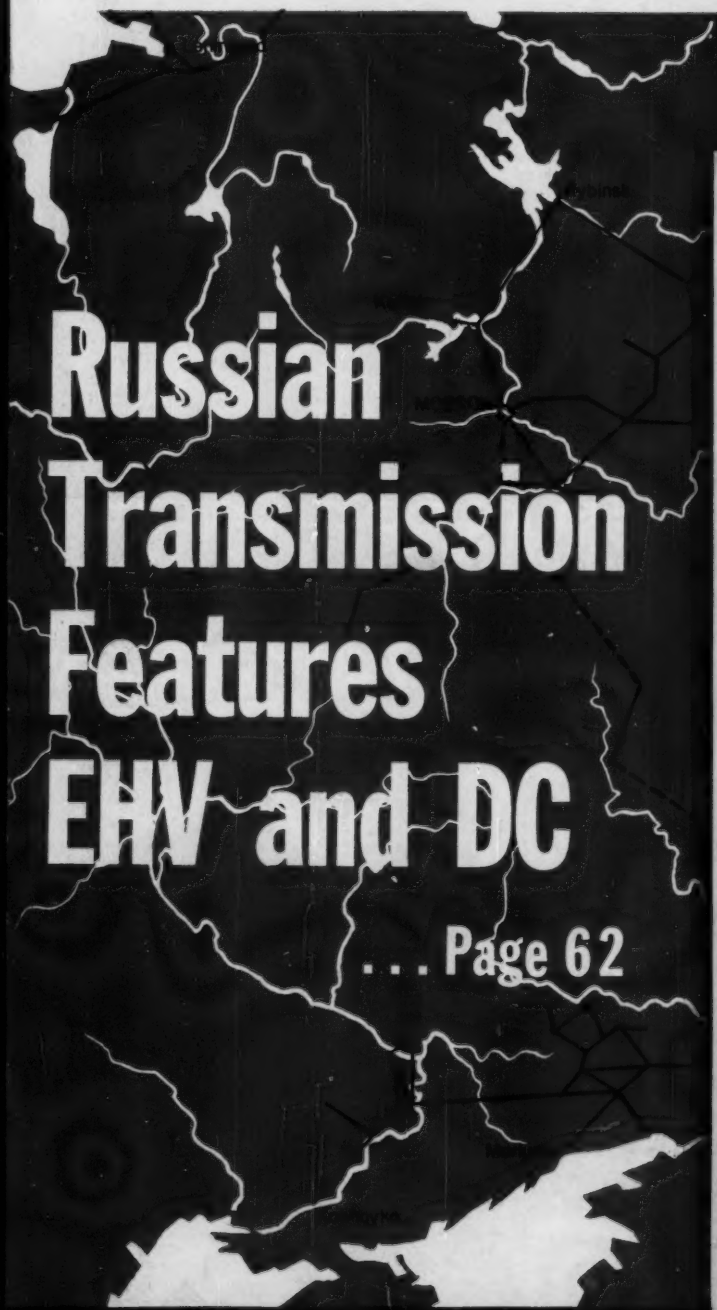

Russian Transmission Features EHV and DC

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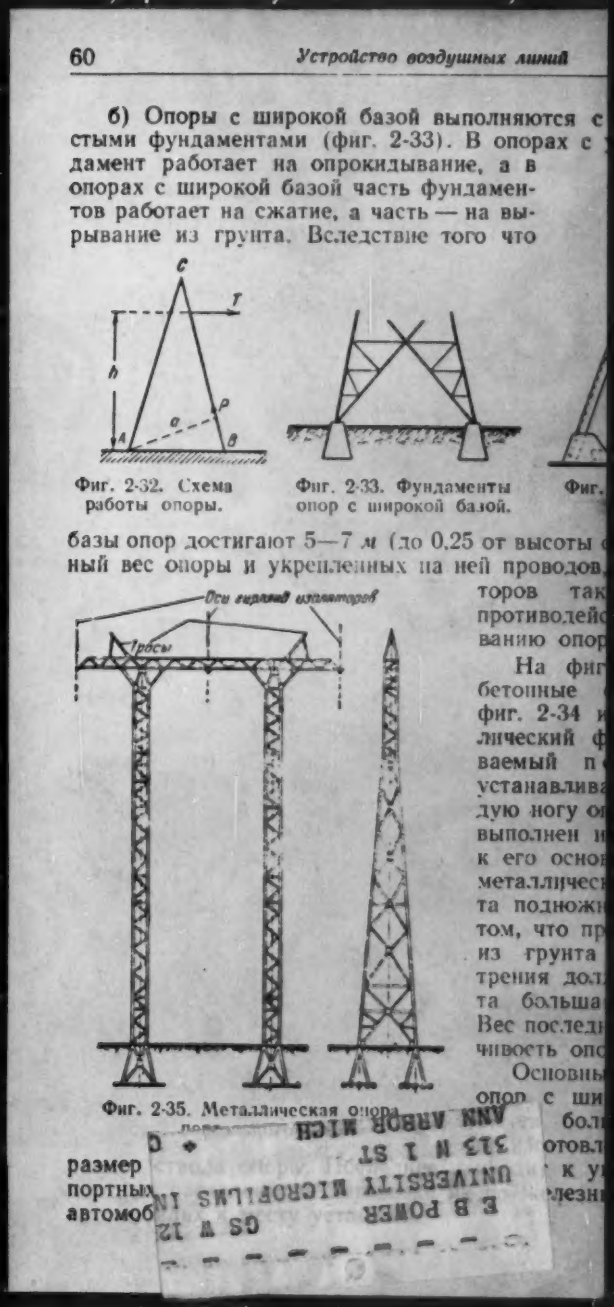
Ernst of Calectric . . . p. 51



60 *Устройство воздушных линий*

б) Опоры с широкой базой выполняются с стыми фундаментами (фиг. 2-33). В опорах с дамент работает на опрокидывание, а в опорах с широкой базой часть фундаментов работает на сжатие, а часть — на вырывание из грунта. Вследствие того что

Фиг. 2-32. Схема работы опоры.

Фиг. 2-33. Фундаменты опор с широкой базой.

Фиг.

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Фиг. 2-35. Металлическая опора

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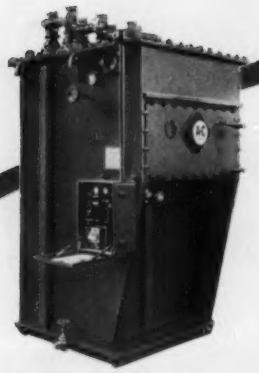


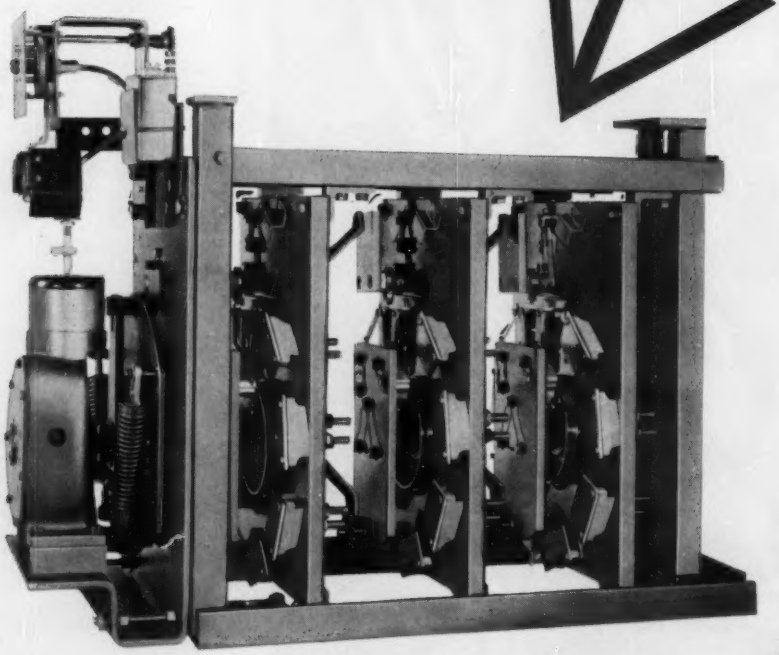
reasons for remarkable service of ALLIS-CHALMERS 3-phase regulators

Simplicity of design is an important reason why the tap-changing mechanism of Allis-Chalmers regulators gives long, truly trouble-free service.

- All moving parts, including driving motor, are completely immersed in oil — nothing to lubricate or adjust.
- Countless gears and cams eliminated to reduce moving parts to a minimum.
- Simple, capacitor-type motor has no commutator, slip rings, brushes or centrifugal switch — can withstand stalled current without damage.
- Taps changed with fast snap action — without shock — without brakes or sealing-in switches.

These are just a few of the many reasons for the outstanding service record of Allis-Chalmers 3-phase regulators. For complete details, call your local A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

simple mechanism



ALLIS-CHALMERS

A-5462

Electrical World

Vol. 148, No. 14 September 30, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Features

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Higher Secondary Voltage a 'Must'

Majority of distribution engineers favor an increase, differ on whether it should be single or three phase.....p 48

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Independent group says ten water heater models and element combinations could meet most industry needs....p 49

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Spot survey finds '57 budgets 'right on the nose' and no prospects for major cutbacks in 1958.....p 50

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SYSTEM ENGINEERING

Digital Computer Aids Load Flow Studies

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Soviet Engineers see EHV ac with capacitors suitable for 2,000 mile lines. DC projected for 800-Kv.....p 62

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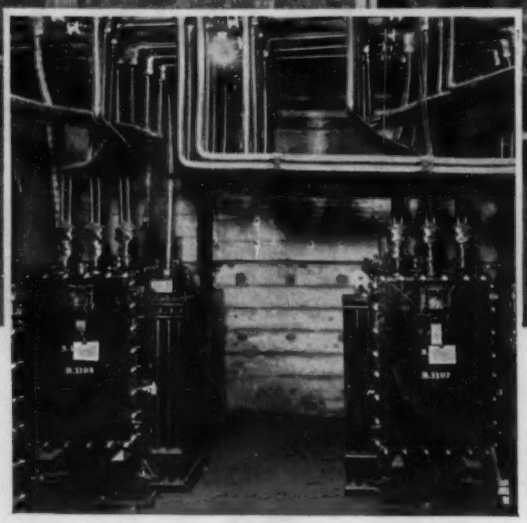

This underground network vault with its array of cables is typical of the up-to-date installations demanded by Pacific Gas and Electric Company in order to render maximum continuity of service to their customers.

Dependable service below pays off above

Pacific Gas and Electric Company's recent installation of nearly seven miles of Keystone butyl-insulated duct cable is just one part of its continuing network expansion to insure dependable power for San Francisco's ever-increasing loads.

Meeting the rigid RO & N specifications set up by Pacific Gas and Electric Company engineers, Keystone butyl-insulated cables offer extra value in their high dielectric strength, moisture resistance, resistance to ozone and corona cutting, and in their ability to take sharp bends and withstand high conductor temperatures. Insulation and sheath are vulcanized together in a construction that withstands the moisture and heat in duct systems and allows simple, damage-free pulling.

Backed by Okonite research and quality control, Keystone butyl-insulated cables offer these service-lengthening features without any increase in cost.

Keystone is one of the family of Okonite insulations: Okolite and Okonex (strip-insulated types), Keystone and Watertite (extruded types). Bulletins are available on each from The Okonite Company, Passaic, N. J.

4188

where there's electrical power . . . there's **OKONITE CABLE**

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. . . *from the publisher*

Man Behind Our Cost Survey

As you read this issue of Electrical World, we will be putting the final touches on our special, 16-page report for next week—The Tenth Steam Station Cost Survey.

KEARNEY

Man responsible for this authoritative report is John J. Kearney, assistant managing technical editor. Jack, now 33, is Electrical World's generation specialist. Since joining our staff in 1954, he has put together two reports on steam station design characteristics, one previous report on steam station costs, and two full-scale reports on nuclear power. These special reports are in addition to his duties as generation specialist, field editor, and adviser for our Atomic Progress page.

Jack's background includes a six-year stint at Ebasco Services where he had a hand in designing Florida P&L's Cutler and Riviera Beach stations and others for Middle South, Minnesota P&L, and Pennsylvania P&L. Prior to that he served as radar expert for the Navy and taught mathematics at Notre Dame.

To these impressive academic and practical qualifications, Jack adds the strong desire to present his material in easy-to-comprehend form to fill your needs. You'll see what we mean in next week's Tenth Steam Station Cost Survey.

Fischer Black

ELECTRICAL WORLD

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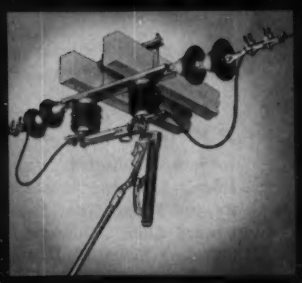
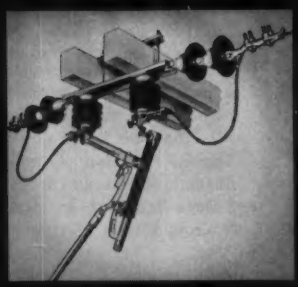
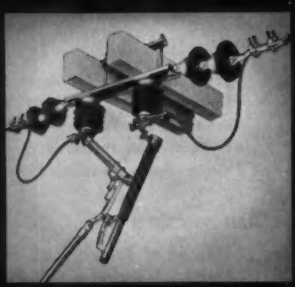
NOW! low-cost load switching for your entire distribution system... just hook Loadbuster® across this new S&C Tool Operated Disconnect



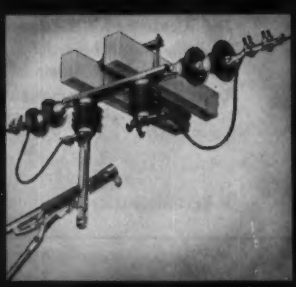
Loadbuster is hooked to attachment hook of disconnect



Loadbuster is pulled downward, opening disconnect blade



Loadbuster interrupts circuit and latches open



Loadbuster freed from attachment hook; to be twisted from pull ring

That's right! Now you can make load switching universal. At the same time you get the rugged reliability you'd expect from a station-type disconnect, while paying no more than you would for distribution-type disconnects.

This new S&C Tool Operated Disconnect switches loads dependably with Loadbuster, S&C's portable loadbreak tool, and it is the only distribution disconnect with published short-time ratings and published insulation values.

Why is this published data important? Just take a look at what has been happening on distribution lines in the past few years—

Today's Disconnect Problem

Performance requirements for disconnects have risen rapidly as a result of higher voltages, 400-ampere loads, and alarming increases in available short-circuit currents. This type of duty might suggest the use of 600-ampere, station-type equipment, but distribution system budgets can't stand the cost.

Yet the job is too heavy for the ordinary distribution disconnect which has inadequate short-time capability, substandard insulation characteristics, insubstantial construction, no load switching potentiality, and extremely limited repetitive capability.

Up until now there has been no device to fill the void—no disconnect suited to a modern, high-reliability, distribution system, yet matching distribution economics. To meet this need, S&C is introducing this Tool Operated Disconnect. It meets the rigorous requirements conventionally filled by group-operated disconnects, hook-operated, station-type disconnects, and conventional load interrupters.

. . . and Load Switching Needs

Load switching is a serious problem today. Primary distribution voltages of 12-14 kv, currents of 100 to 400 amperes, and the associated charging and magnetizing currents cannot be switched without establishing persistent, spreading arcs.

Until recently, the only dependable solution to load switching needs has been the load interrupter, whose cost can only be justified at substations, subtransmission sectionalizing points, and at key sectionalizing points. Now with this new disconnect you can have universal load switching—economically—using Loadbuster.

Portability the Key

The key to the Loadbuster system of load switching lies in portability —bringing the interrupting device to a matched disconnect or cutout only when load switching is desired. The cost of Loadbusters is spread over all the disconnects and cutouts in a distribution system.

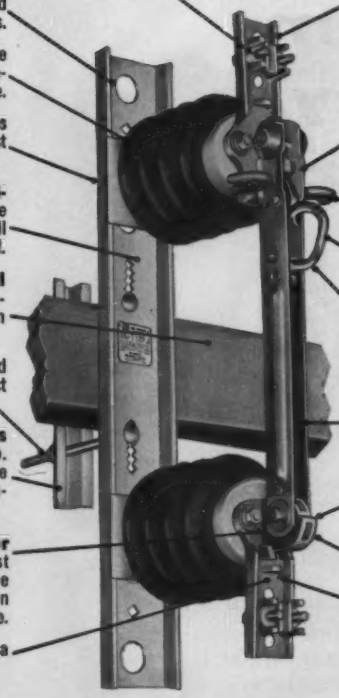
Today you can solve the disconnect problem for your system with S&C's Tool Operated Disconnect . . . a distribution device that doubles for station-type equipment. And since this Tool Operated Disconnect is matched to Loadbuster, load switching comes free! Write for full information.

How Loadbuster Works

Attached to a universal pole, Loadbuster is simply hung on the attachment hook of the Tool Operated Disconnect, and the pull ring hook inserted in the pull ring. As the pole is pulled downward, the disconnect is opened, but a current path is retained through Loadbuster. As the movement continues downward, Loadbuster trips, breaking the circuit positively. It's that easy! There's no arc, no contact burning, and no danger to the lineman operator.

Designed to withstand usage over a long time without maintenance, Loadbuster is operable at any distribution system voltage through 14,400 volts, and can break all load currents through 400 amperes, as well as associated magnetizing and line charging currents; it can also switch all pole top capacitor banks.

the new S&C Tool Operated Disconnect



Connector Bolts can be inserted in one direction only so electrical clearance cannot be shortened.

Dead-Ending Provision base has holes in each end for dead-ending conductors.

Post Insulators provide large leakage distance between live parts and base.

Husky Channel Base gives flat bearing surface against crossarm.

Versatile Mounting Provisions for single and double crossarm, also structure; all needed hardware included.

10½" Metal-to-Metal Open Gap Distance is unusually long for distribution disconnects.

Mounting Bolts extend away from blade, protect clearances to live parts.

Rigid Back-Up Members permit secure draw-up. Bolts insertable only in one direction as shown to maintain electrical clearance.

Double-Stud Insulator Mount insures against shifting or turning of live parts, particularly when closing blade from the side.

Current Path virtually a straight line.

Dual-Purpose Connectors tinned to take aluminum or copper. Large area, reversible clamp accommodates wide range of conductors—up to 450 Mcm copper and 336 Mcm ACSR.

Silver-to-Silver Contacts backed up by stainless steel contact pressure springs.

Attachment Hook for Use with Loadbuster also serves as blade guide.

Positive Latch and Pry-out operates freely from all angles of approach.

Pull Ring Position gives compact construction—with minimum clearance requirements for open blade.

Heavy, Embossed Blades insure positive alignment when closing in.

Machined Contact Surfaces for best possible contact.

Positive 90° Blade Stop

Cable Stop prevents cable end from interfering with disconnect blade action.

15 kv—400 amp

Only Distribution Disconnect with Published Performance Data

The performance built into this disconnect (see below) is unmatched in the field of distribution disconnects . . . and the S&C Tool Operated Disconnect costs no more. Plus cost-free load switching! Designed for use with Loadbuster®, this disconnect is, when required, a load interrupter for currents up to 400 amperes.

That this disconnect will give years of maintenance-free, urban or rural service is clear from the construction details shown at the left.

The new disconnect comes complete with all necessary hardware for both single or double crossarm mounting (vertical or inverted), for use with both aluminum and copper conductors. There is nothing extra to buy or to specify.

	Kv			Amperes			Inches			
					Short Time				Withstand Test Voltage kv (Min), 60-cycle	
	Nominal	Max Design	Impulse Withstand (BIL)	Continuous	Momentary	4 sec	Leakage Distance	Dry Arcing Distance	Wet 1 min	Wet 10 sec
Branch Feeder	15	15	95	400	20000	12500	13-3/4	6	50	42
Main Feeder	15	15.5	110	400	20000	12500	17	7-1/4	50	45
Station Pin Insulator	15	15.5	110	400	20000	12500	12	7-1/4	50	45
Station Post Insulator	15	15.5	110	400	20000	12500	15-1/2	7-1/4	50	45

Specialists in High-Voltage Circuit Interruption Since 1910

S&C ELECTRIC COMPANY

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

An example of Allis-Chalmers

550-BIL Transformer for 161-kv system raises efficiency, cuts weight, size

Here's dramatic proof of progress!

Close manufacturing control is illustrated by this A-C designed machine used to place precisely the tens of thousands of spacers for directing oil flow.

Valuable experience was gained from building and using this 600-kv transformer for test and research.

A few years ago a 46,667-kva transformer with a combination of reduced insulation, corona-free design, high short-circuit strength and quick-break tap changer would have been the sensation of the industry.

Today, as a result of design research and experience, production of transformers like this is a reality.

Insulation for this 161-kv transformer would normally be used for 115 and 138-kv units. This reduction of two steps is the result of coordination of modern "corona-free" insulation and improved system overvoltage protection. It makes possible substantial savings in weight, size and cost while increasing efficiency without sacrificing reliability.

Concentrated research on reduced insulation was begun by Allis-Chalmers in the 1930's. After the interruption of World War II, new test methods and manufacturing controls were developed to take advantage of this advanced engineering knowledge. As a result, today's A-C transformer is constructed on a triangle of quality: experience . . . design . . . and close manufacturing control.

For details on the engineering of this interesting design, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

leadership in transformers

550-BIL Transformer being shipped to Northern States Power Company.

Pioneer Service & Engineering Co.

A-C ALLIS-CHALMERS

A-5510

NEW

Automatic Outage Locator

Identifies Power Failure

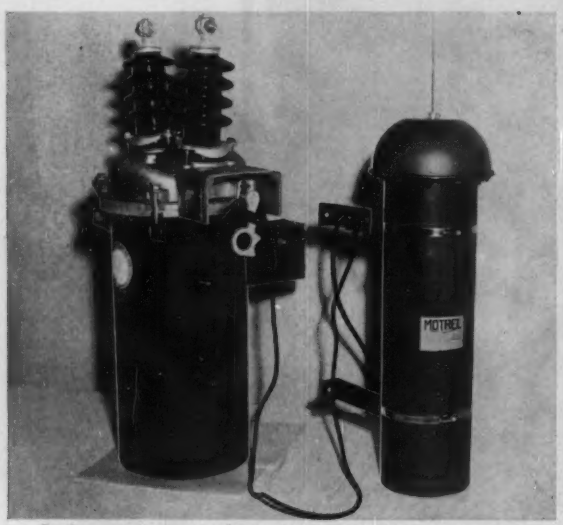
Instantly

via Space Radio

FCC Docket No. 12028 permits electric utilities to engage in one-way signaling on mobile frequencies to indicate electric line outages.

Completely Automatic!

Motrel's Automatic Outage Locator is an FM Transmitter operated automatically in response to a tripped associated recloser, fuse or circuit breaker. Each sectionalizer, equipped with an outage locator, transmits a distinctive coded signal which identifies that sectionalizer. This coded information is received directly by mobile units or base station. The locator provides maintenance with immediate notification of line failure . . . **without subscriber participation.**



Recloser, actuator and Motrel Automatic Outage Locator.

- **Easy Installation . . . Minimum Maintenance**

  Lightweight Motrel Outage Locator is installed in minutes. Operates only at time of power failure. Hermetically sealed against all deteriorating and aging factors.

- **Inexpensive**

  Cost of unit, installation and maintenance nominal. Automatic Locator pays for itself over a short period of time.

- **Saves Time . . . Manpower**

  Saves location time on service restoration trips to release men to new construction. Prevents backtracking by signaling maintenance of last point of continuity.

- **Creates Customer Good Will**

  Locates power failure without subscriber participation. Helps determine individual subscriber troubles (house fuses, etc.).

- **Reduces Jamming and Congestion**

  Saves telephone switchboard jamming and reduces voice transmission on congested mobile frequencies.

MOTOREL, INC. Ryan Airport, Hangar 1 Baton Rouge, La

Please send complete information and price on Motrel Automatic Outage Locator.

Name _____

Firm _____

Address _____

City _____ Zone _____ State _____

MOTREL INCORPORATED

Patent pending on Motrel Locating System

NEWS-SCOPE

FUTURE NEWS ▶ **Many electric utilities now owning their own automobile fleets** are looking at the possibility of leasing them.

Electric space heating for comfort in industrial plants will almost double in 1958. Connected heating load will jump an estimated 100% also. This was revealed by a recent EW survey covering heat pumps and resistance heating equipment. Survey shows utilities becoming more conscious of this market.

LATE NEWS ▶ **A controlled fusion breakthrough may be near in Britain.** Tests last week with torus discharge apparatus at Harwell produced gas temperatures of 1-million degrees centigrade during millisecond intervals. Temperatures of about 50-million degrees are necessary for sustained thermonuclear fusion to produce power.

Objections of 13 Wyoming towns to assessment and taxation of their municipally-owned electric utilities are overruled by state equalization board. Answering claims that utilities were a governmental function, the board found 10% of power goes to community users, the rest is sold. An appeal to Wyoming Supreme Court is expected.

Organic Moderated Reactor Experiment at Arco, Idaho, goes critical for the first time. OMRE, developed for AEC by Atomic International Division of North American Aviation, will produce about 16 Mw heat when full power operation is achieved.

State Department selects John E. Corette, Montana Power president, as U. S. delegate to a United Nations conference on electric power. The session, to be held Oct. 7-10 in Geneva, Switzerland, will study questions relating to the transmission of power across national boundaries and rural electrification problems.

FPC issues a partial 50-year license to New York Power Authority to undertake development of the Niagara Falls hydroelectric project. The commission reserved action on two phases—the conduits and the size of the reservoir—which are being opposed by two nearby towns and Niagara County. A hearing is slated for October 1.

Two utilities have signed wage hike pacts. New two-year contract between Wisconsin-Michigan Power and IBEW provides for a 4½% wage boost for the first year and 4% for the second plus a cost-of-living factor for both years. Meanwhile, Pennsylvania P&L and UWUA agree to a 5¼% hike. Other two unions had settled earlier.

To help the manager or supervisor keep productivity and morale at the highest peak, EEI is "now working diligently and expects shortly to be able to submit to the industry a carefully considered program for employee information."

Congratulations . . . Newly appointed general manager of Power Reactor Development Co is R. W. Hartwell . . . A. B. Collins, Jr, joins staff of Reddy Kilowatt, Inc, as assistant to the president.

EVENTS ▶ **Higher secondary voltages for residential loads**—this was a majority choice of a group of distribution engineers who pondered the subject recently. But the experts disagree on whether single or three-phase systems should be designed (p 48) . . . Joint utility-manufacturing committee proposes ten standard water-heaters which may satisfy 75% of industry's needs (p 49).

WASHINGTON ▶ **Seventeen utilities are charged with overstating net earnings** by not recording deferred taxes. F. M. Beatty of Arthur Anderson & Co made the charge in a hearing before FPC regarding proposed changes to the uniform system of accounts (p 52).

SYSTEM ENGINEERING ▶ **A digital computer has solved American Gas & Electric Service Corp's** load-flow problems so fast and economically that it has been tagged to solve all future major load studies. It calculated load-flows for the entire AG&E system in 1.75 computer hours at a cost of $1,300 for computer time. To run the same study on the largest network analyzer would have required seven days and $2,800 charges. In addition, the computer yielded greater flexibility because the studies could be interrupted at any time without incurring a cost penalty (p 60).

GENERATION ▶ **Full boiler pressure and generation can be obtained more quickly** after a shutdown if silica-contaminated condensate is dumped and boiler feedwater is drawn from the condensate storage tank during the startup period (p 74).

TRANSMISSION ▶ **Russian engineers are expanding their 400-kv ac transmission** as the solution to long-distance, bulk-power-transfer problems. The first line, already in service, consists of two single circuits on separate portal-type towers. The two circuits can carry 1,150 Mw. They consider 400-kv ac suitable for 2,000 miles. In the dc transmission field, Russia does not yet have a truly commercial line, but a 70-mile, 200-kv, 30-Mw scheme convinces them that dc offers economic and technical advantages. They plan a 340-mile, 800-kv line of 750-Mw capacity to be built about 1960 (p 62).

SUBSTATIONS ▶ **Duke Power has cut costs of a 115-kv substation** at its Allen Plant by mounting modified selector switches on the buses and their structures. This cut selector switch cost 60% and permitted changes that (1) Reduced the required bus supports, fittings, and connectors; (2) Cut steel tonnage 60%; (3) Simplified erection; and (4) Provided better spacing between equipment. Full technical details appear on p 57.

DISTRIBUTION ▶ **A strong, inexpensive temporary service setup** has been developed to enable utilities to provide light construction power more easily at sites which lack facilities for permanent service drops. The device is a braced timber column set nearly 4 ft into the ground, which takes the service drop and supports the meter and switchbox (p 70).

An automatic device that adjusts cooling water for network transformers in underground submersible vaults cuts water requirements 80% yet permits a 33% increase in bank capacity. An enclosed temperature-sensitive switch is inserted into the transformer oil and works a solenoid valve **(p 70).**

BUDGETS ▶ **Electric utilities hold firm to expansion plans** for 1957 and 1958. Spot Electrical World survey fully supports our forecasts published earlier this month (EW, Sept. 2). There has been some inventory trimming during the year as equipment deliveries improve **(p 50).**

RATES ▶ **Plymouth County Electric Co has asked for a $251,500 annual rate** hike . . . Southern Nevada Power Co requests a 13.8% jump—a $1.06 million increase . . . Bowling Green (Ohio) Electric Dept has announced a 10% reduction . . . Los Angeles Water & Power now can raise or lower rates when price of fuel affects the base rate of 3 mills per kwhr **(p 101).**

HEATING & COOLING ▶ **One of the largest industrial plant heat pump installations** is now in service in southwest Virginia. But selling the heat pump was no easy job for Appalachian Electric Power. Three groups had to be convinced of the heat pump's economy: The plant's builder (an area-development firm), the manufacturer, and architects. The first bids, based on a coal-fired heating system and conventional forced ventilation, were too high. Revising the building plans to include heat pumps and exclude windows finally resulted in an acceptable bid **(p 78).**

PEOPLE ▶ **"Give a man a job and let him do it."** With this philosophy, carried traditionally ever since California Electric Power's founding fathers first decreed it, Calectric's new president, Carl C. Ernst, moves into the top executive spot. Ernst was hired 37 years ago on a temporary basis. Since then, he's been a lineman, superintendent, district manager, and vice president. In EW's profile of him, **Ernst speaks out against federal power (p 51).**

At Public Service Electric & Gas, Frank Freer, Jr. has been appointed comptroller replacing F. Warren Cooper, retired **(p 112).**

NEW EQUIPMENT ▶ **Axial-steam-exhaust turbine is being designed** to improve efficiency and cut construction costs **(p 104).**

MANUFACTURERS ▶ **Disconnect switch interrupts 400 amps safely** in combination with a portable loadbreak tool; works at 15 kv; withstands 95-kv jolt . . . New line of substation transformers comes in ratings up to 15 kv, 250 to 500 kva single-phase; they are smaller, lighter . . . Monitoring system for hydrogen-cooled generators records moisture present in the coolant and sounds alarm when it becomes excessive **(p 86).**

ENGINEERING TRENDS

Cool blue and green fluorescent rays are 2½ times more efficient than hot red and yellow rays from incandescent lights in stimulating hen egg-laying according to the agricultural experiment station at the University of Connecticut.

You can now talk through your hat as a result of the latest development of the U. S. Army Signal Engineering Laboratories. The laboratories have developed a helmet which incorporates solar batteries as the means to provide necessary electrical power for a radio transmitting and receiving set. Small storage batteries are included for night-time operation.

Diesel-engine wear can be measured within two minutes with a new electronic device used by the Pennsylvania Railroad. Known as "Quantometer" it reacts to minute quantities of metal in oil—as little as one or two millionths of a gram of metal in a gram of oil—and automatically records the amount found.

Salmon ladders increase number of fish in upper level pools. A 1,575-ft long ladder with over 1,200 ft running through a 7-ft diameter rock tunnel will enable salmon to reach the waters above the 90-ft high Ranfossen waterfall in Norway. The salmon yield in the upper waters is expected to increase from ½ ton to 75-80 tons per year.

High resistance faults in cable buried 12 to 15 ft can be located readily for repair by a light-weight ferrite core pick up coil and transistorized amplifier developed for Navy Bureau of Aeronautics. Indicator is a built in micro-ammeter which can be supplanted by a head set. According to **Electronics** a 250 cps intermittent tracer is applied at a convenient access point and traced with the pick up to the point where reception suddenly stops or drops off suddenly. Excavating at this point exposes the faulted cable.

FROM EDITORS IN THE FIELD

Cooling tower lumber treatment efficacy will be tested by Southwestern Public Service Co engineers at new Cunningham station. Half of the tower has treated redwood, the other half has untreated redwood. Because both halves will be subjected to the same conditions, engineers believe tests will be conclusive.

Disregard of broken conductor considerations in tower line design is being studied seriously by some engineers. Tower costs could be appreciably reduced if designed on this basis. In reconductoring a line on towers, Indianapolis Power & Light Co engineers are not considering broken conductors in determining tower reinforcement requirements. Public Service Co of Indiana is studying the possibilities in plans for a new tower line.

In O-B's full line of hardware you'll find materials made for your requirements

Our only consideration in designing and manufacturing hardware for transmission and distribution lines is what material or method will do the job best at a reasonable cost.

O-B makes clamps and other hardware out of bronze, malleable iron or aluminum. We cast in both sand and in permanent molds. When forging will produce the best product, we forge it. We have the facilities to bend, form, weld or to perform whatever other fabrication technique may be needed.

These facts are important to you in designing and building a transmission or distribution line. You don't have to be concerned about whether one method of manufacture is better than another. Merely select the design that you want and buy from O-B with assurance it's made by the best method out of the best material for your application.

Ohio Brass

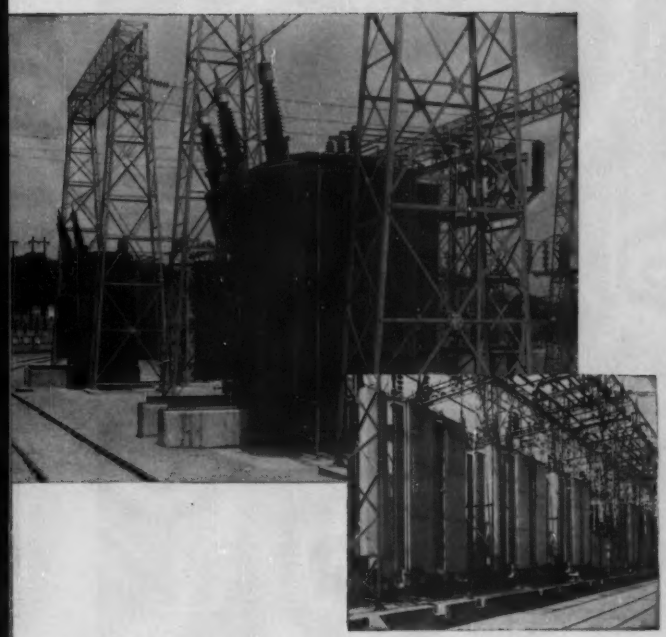
OHIO BRASS COMPANY • MANSFIELD, OHIO

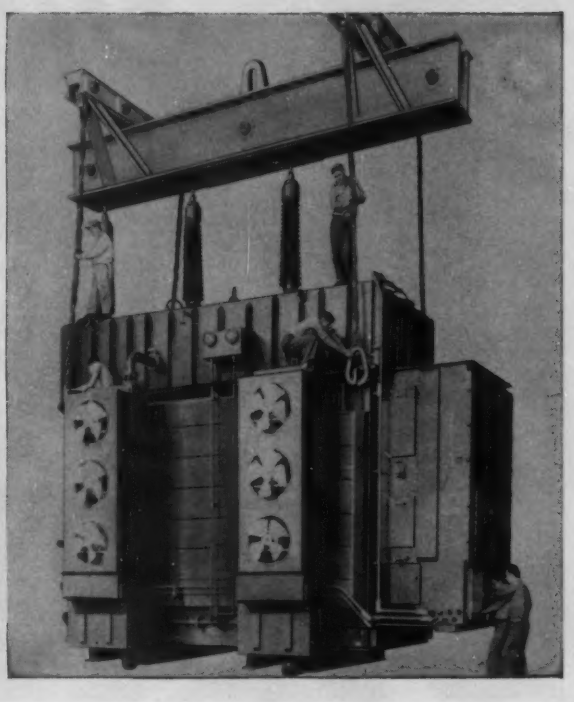
MOLONEY ELECTRIC

Power Transformers • Distribution Transformers • Load Tap Changing Transformers
Primary Unit Substations • Secondary Unit Substation Transformers
Subway Transformers • Industrial Dry Type Transformers

SALES OFFICES IN ALL PRINCIPAL CITIES

A NUMBER...





Any number that fits your needs . . . Kva that is, and Moloney can supply it. Regardless of the rating required, Moloney has the engineering experience, the facilities and the capacity to produce the transformers you need.

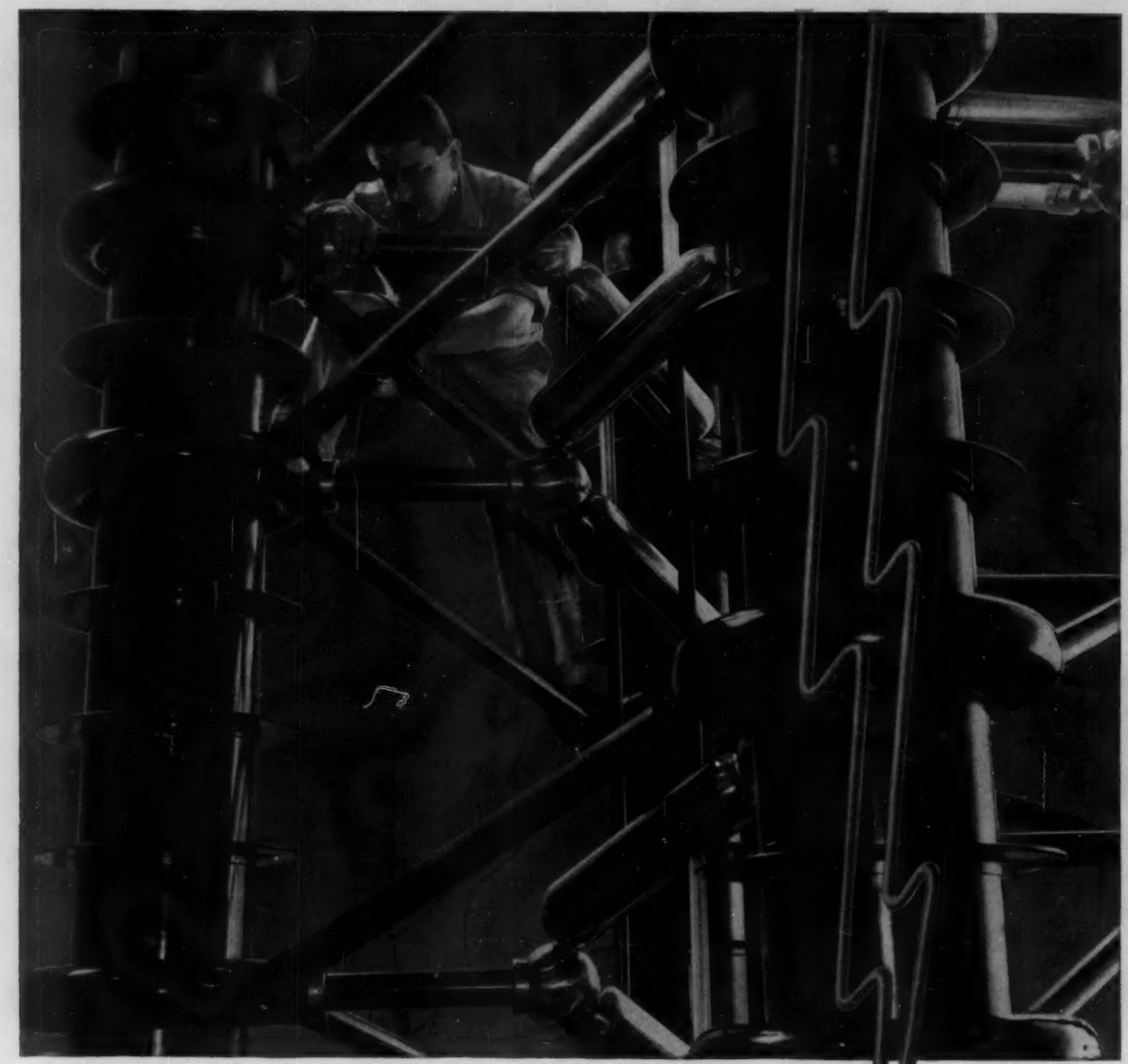
Of primary importance to utilities is the fact that Moloney Transformers in the field have unequalled operating records. Then too, Moloney engineering is recognized for the ability to solve problems that are unique to particular utility systems. This engineering ability and experience, functioning within the confines of the industry's finest facilities, leads to the production of transformers of any size and rating that are best suited to perform as specified. Add to this Moloney field-proved, revolutionary load tap changing equipment and you have the nucleus around which to build the best transmission and distribution installations.

ME56-20

MOLONEY ELECTRIC COMPANY

Regulating Transformers • Step Voltage Regulators
Network Transformers • Series Street Lighting Transformers
Capacitors • Transformers and Inductors for Electronics

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA



Simplex Wire & Cable Company's new 1,400,000 volt impulse generator — the first of its kind to be installed in North America — represents just one aspect of research at Simplex. Simplex scientists and engineers originated the process of vulcanizing portable rubber cords and cables in a lead mold. Simplex developed the first heavy-duty portable electrical cable — Simplex TIREX. The first truly moisture-resistant rubber insulation was the outcome of a commercially acceptable method of deproteinization developed by Simplex. Simplex designed the first interlocked armored cable for underground service — Simplex CONDEX. And now — Simplex C-L-X — the portable, corrugated metallic duct WITH SEALED-IN CABLE. **SIMPLEX WIRE & CABLE CO.**, Cambridge, Massachusetts and Newington, New Hampshire.

Simplex

LIVE BETTER ELECTRICALLY

Highest quality cables for: Mining • Power & Lighting • Construction • Transportation • Communications • Signalling

TIME IS THE MEASURE OF ALL WOOD PRESERVATION

In business–as in pleasure–it's important to safeguard your investment in wood. Service records show that AMCRECO pressure treatment still provides the longest and most practical protection.

AMCRECO
PRESSURE TREATED WOOD PRODUCTS

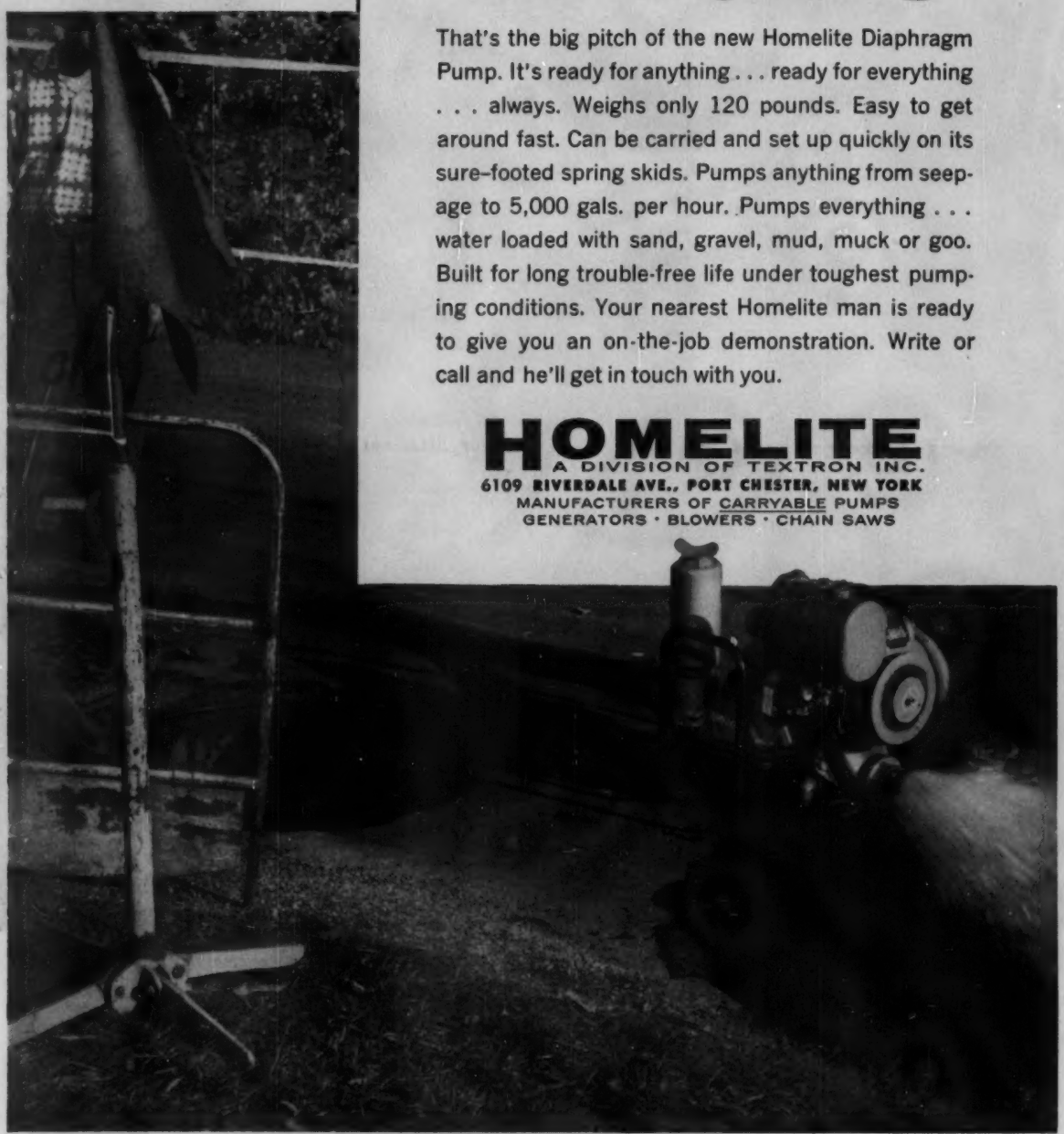
AMERICAN CREOSOTING CORPORATION LOUISVILLE 2, KENTUCKY
SUBSIDIARY OF UNION BAG-CAMP PAPER CORPORATION

READY

For Anything

That's the big pitch of the new Homelite Diaphragm Pump. It's ready for anything . . . ready for everything . . . always. Weighs only 120 pounds. Easy to get around fast. Can be carried and set up quickly on its sure-footed spring skids. Pumps anything from seepage to 5,000 gals. per hour. Pumps everything . . . water loaded with sand, gravel, mud, muck or goo. Built for long trouble-free life under toughest pumping conditions. Your nearest Homelite man is ready to give you an on-the-job demonstration. Write or call and he'll get in touch with you.

HOMELITE
A DIVISION OF TEXTRON INC.
6109 RIVERDALE AVE., PORT CHESTER, NEW YORK
MANUFACTURERS OF CARRYABLE PUMPS
GENERATORS · BLOWERS · CHAIN SAWS



New Westinghouse
10 Kvar Capacitor

ADDING 10 KVAR SECONDARY CAPACITORS NOW EASIER THAN EVER

Westinghouse offers a new 10 kvar type FPS capacitor to improve power factor on single phase, 60 cycle, 240 volt secondary systems. Here is a compact, light-weight package that is as safe and easy to install as the smaller 3, 5 and 7½ kvar capacitors which Westinghouse pioneered.

First, the top hanger is fastened to the pole with a lag screw . . . the capacitor with the lower hanger attached is then hung and the lower hanger lagged to the pole. Then simply connect the line leads and the Westinghouse capacitor begins to pay off in increased load capacity, reduced load losses and improved voltage level.

Once you've hung Westinghouse capacitors you can forget them. Thousands of installations have proven the effective seal used with the porcelain bushings. And the lifetime finish of heavy metallic zinc protects outdoor installations indefinitely from weather, rust, corrosion and abrasion.

For detailed information call your Westinghouse sales engineer. J-60093C

YOU CAN BE SURE...IF IT'S

Westinghouse

When the weather's bad you can say . . .

today's the day to work on Shelterfor-M*

Extensive floor space inside the shelter area allows crewmen to pass two breakers past one another.

Cold, rain, snow or sleet . . . your crews can work *inside* on *outdoor* switchgear when you have Westinghouse Shelterfor-M. No longer is it necessary to hang canvas tarps and build make-shift shelters to work on breakers, instruments or relays when the weather is bad. In fact, maintenance men *use* the wet weather to work in the new Westinghouse metalclad switchgear . . . and save the pleasant days for the regular exposed-to-weather installations.

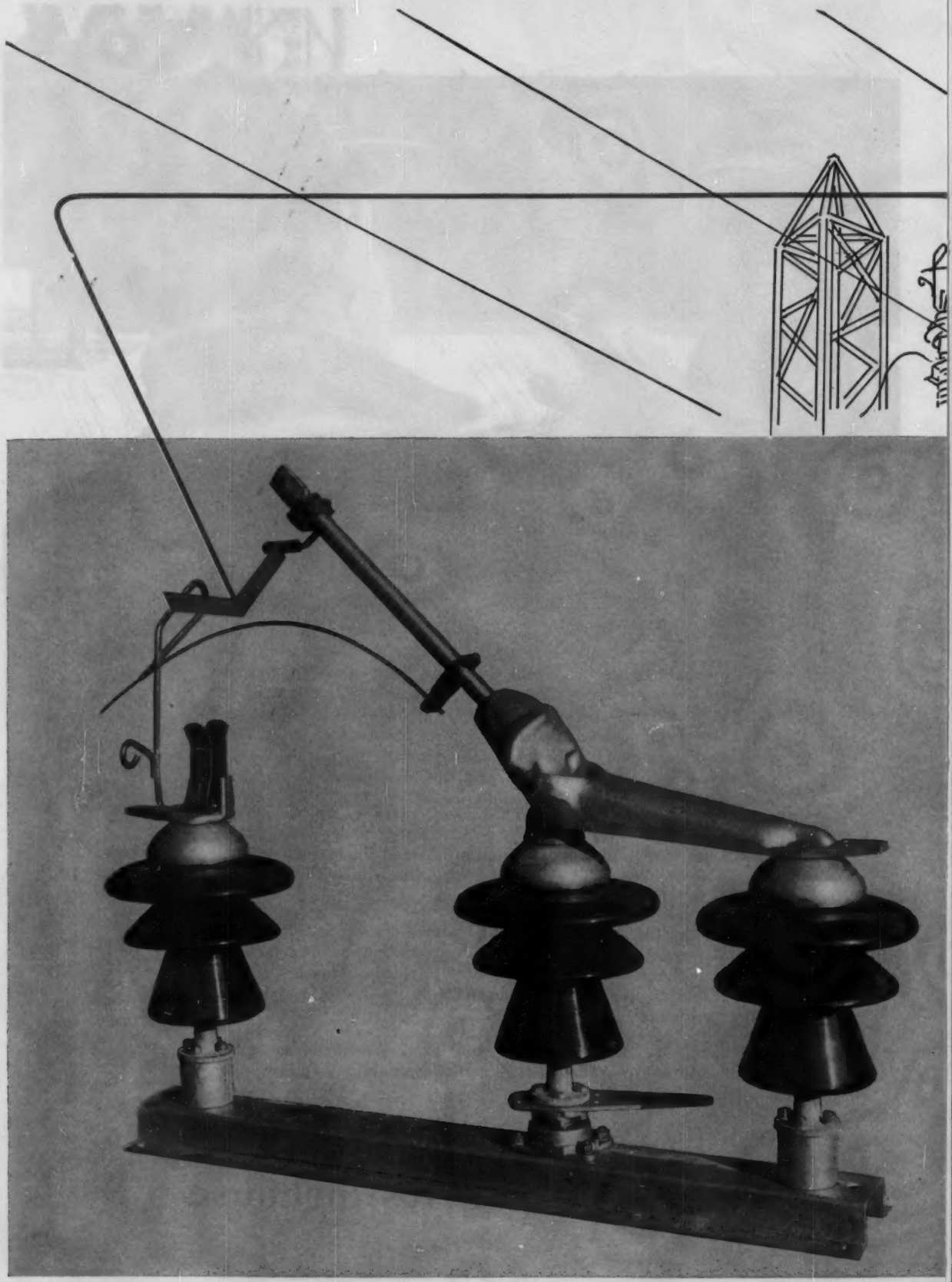
Roomy interior of the Shelterfor-M switchgear allows instrument panels to swing wide for front drawout of breakers for inspection and testing. Two breakers can be passed, side-by-side, even with the doors open wide, inside the covered passage-way.

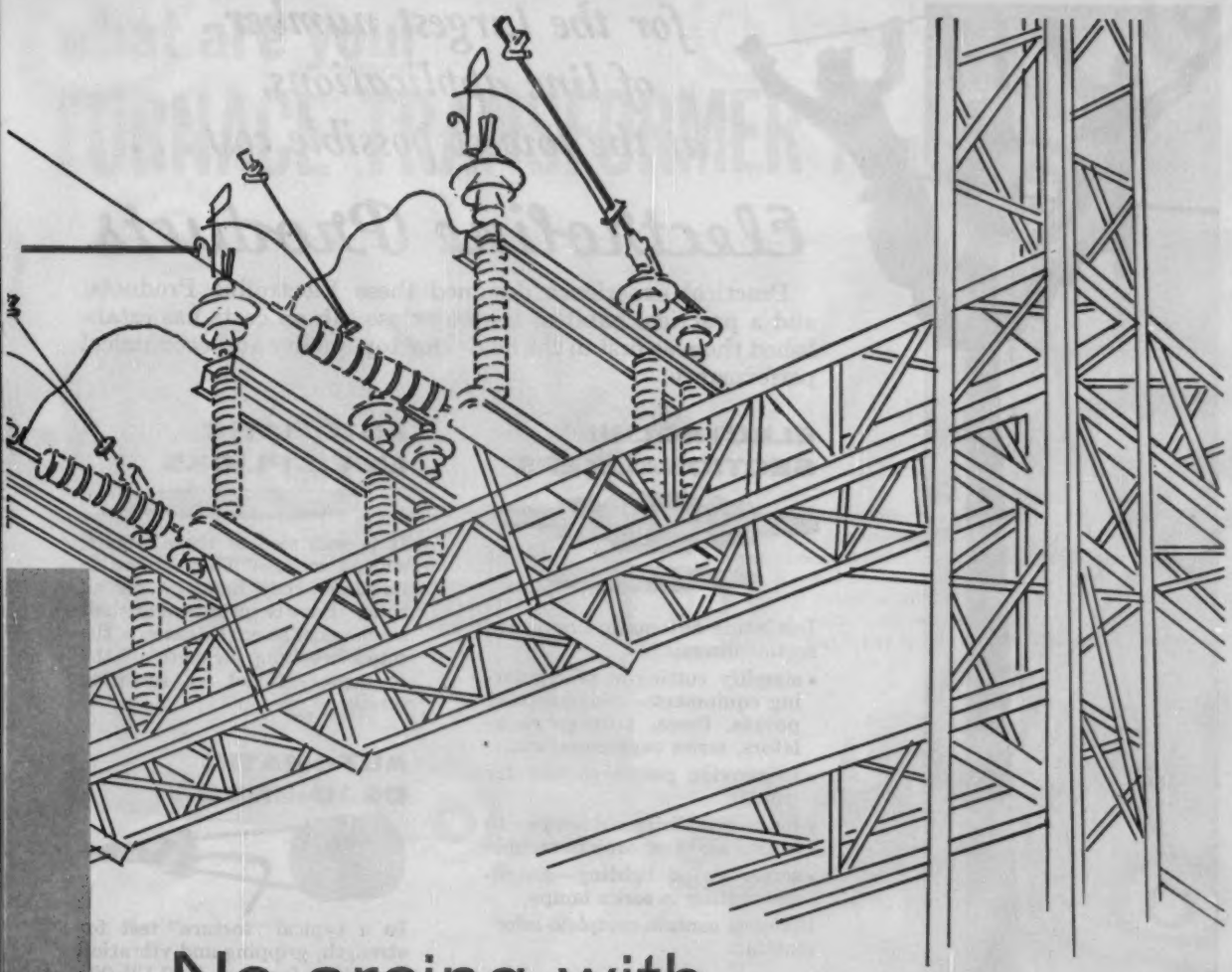
You also get the many outstanding features of standard Westinghouse switchgear: undercoating, multicoat painting and Bonderized finishing, to eliminate rust and corrosion. Exclusive Redarta® flame retardant insulation. Jig-welding construction for interchangeability of like-rated breakers.

For complete information call your local Westinghouse sales engineer or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60024

*Shelterfor-M . . . shelter for maintenance

YOU CAN BE SURE... IF IT'S Westinghouse





No arcing with quick-break arcing horn

Interrupting 46 KV—35 amp load current

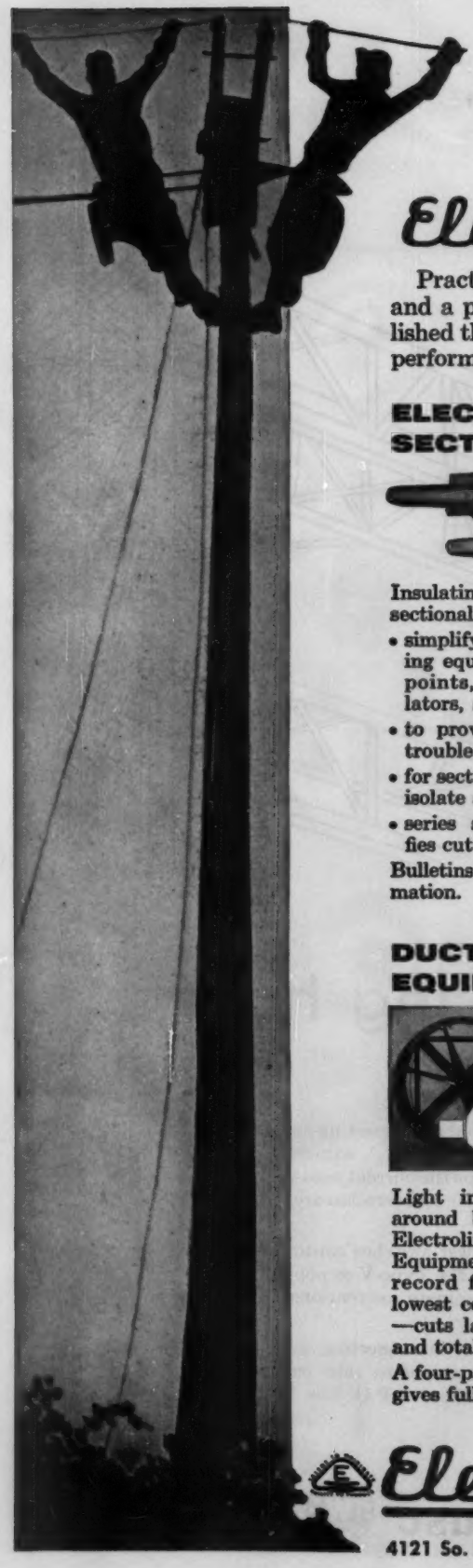
Quick-break arcing horn of the new Westinghouse Type-V disconnecting switch means surer, safer interruption of load or line charging current . . . without arcing. High tensile alloy-spring-steel of the arc horn snaps the current contact open to effectively break 46,000 volt circuits. Contact wear and errosion are practically eliminated.

This newest addition to the Westinghouse line of power switches continues to feature many of the time-proven designs that have made the Type-V so popular, such as: the totally-enclosed hinge-end contacts that eliminate conventional flexible shunts.

For complete information on the Westinghouse line of disconnecting switches, with capacities from 7.5 kv through 69 kv, call your Westinghouse sales engineer. Or write Westinghouse Electric Corporation, 3 Gateway Center, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-60932

YOU CAN BE SURE...IF IT'S Westinghouse



for the largest number of line applications, at the lowest possible cost . . .

Electroline Products

Practical experience designed these Electroline Products; and a practical habit of keeping close tab on costs has established them as first in the field—for top quality and economical performance.

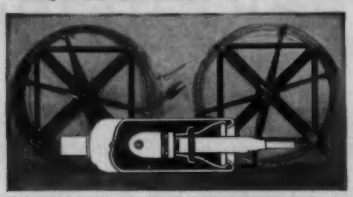
ELECTROLINE SECTIONALIZERS

Insulating automatic line splice sectionalizers:

- simplify cutting-in of regulating equipment—disconnecting points, fuses, voltage regulators, series capacitors, etc.
- to provide points to test for trouble
- for sectionalizing networks—to isolate and test area in trouble
- series street lighting—simplifies cutting-in series lamps

Bulletins contain complete information.

DUCT-RODDING EQUIPMENT



Light in weight, feeds easily around bends, easy to handle. Electroline Steel Duct-Rodding Equipment has an extraordinary record for high efficiency at lowest cost. A big money-saver—cuts labor cost, original cost and total investment.

A four-page illustrated brochure gives full information.

AUTOMATIC LINE SPLICES

It is well said of these simple, rugged units—"They go on in no time; they hang on for all time." Easy to install—and their mechanical strength exceeds the rated breaking strength of the conductors. Ideal for restoring service.

AUTOMATIC DEAD-ENDS

In a typical "torture" test for strength, gripping and vibration damping features, 100,125,000 recorded vibrations did not develop any sign of failure of conductor in these rugged dependable Dead-Ends. Engineers call it equivalent to 50 years of ordinary service.

Electroline Service-Drop Automatic Dead End. The "3800" Series for holding pre-assembled service cable using a bare neutral conductor as the messenger.

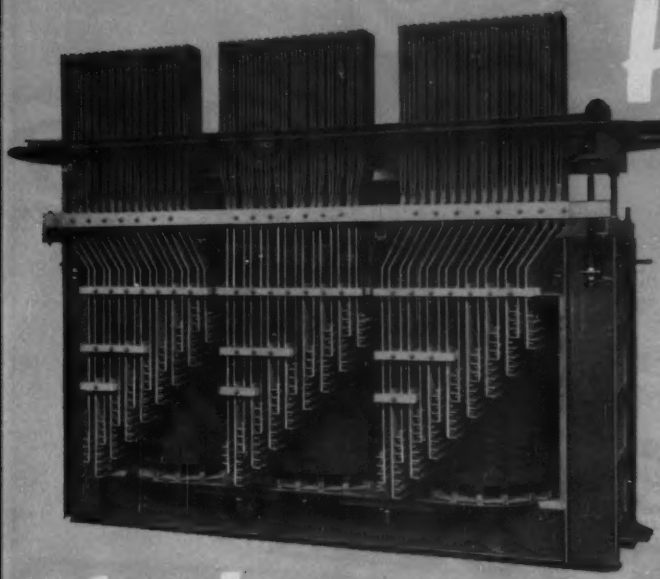
The method of gripping the bare neutral employed by this ELECTROLINE Anchorage eliminates the danger of short circuiting the phase wires so common with the use of concentric cable clamps.

ELECTROLINE Service-Drop Anchor Bracket. The "4000" Series for securely supporting the cable at any angle.

Electroline Company

4121 So. LaSalle St., Chicago 9, Ill. *In Canada:* **POWERLITE DEVICES, LTD., TORONTO**

what are your FURNACE TRANSFORMER requirements?



High Current?

The 82,000-ampere low voltage line current for which this Pennsylvania Furnace Transformer is designed is one of the highest current ratings ever provided for a furnace transformer in this country. The transformer is rated at 16,000/21,300 kva. High voltage: 13,200△ volts. Low voltage: 250△ volts with a full-capacity tap range in 10-volt steps down to 150 volts.

Fast Delivery?

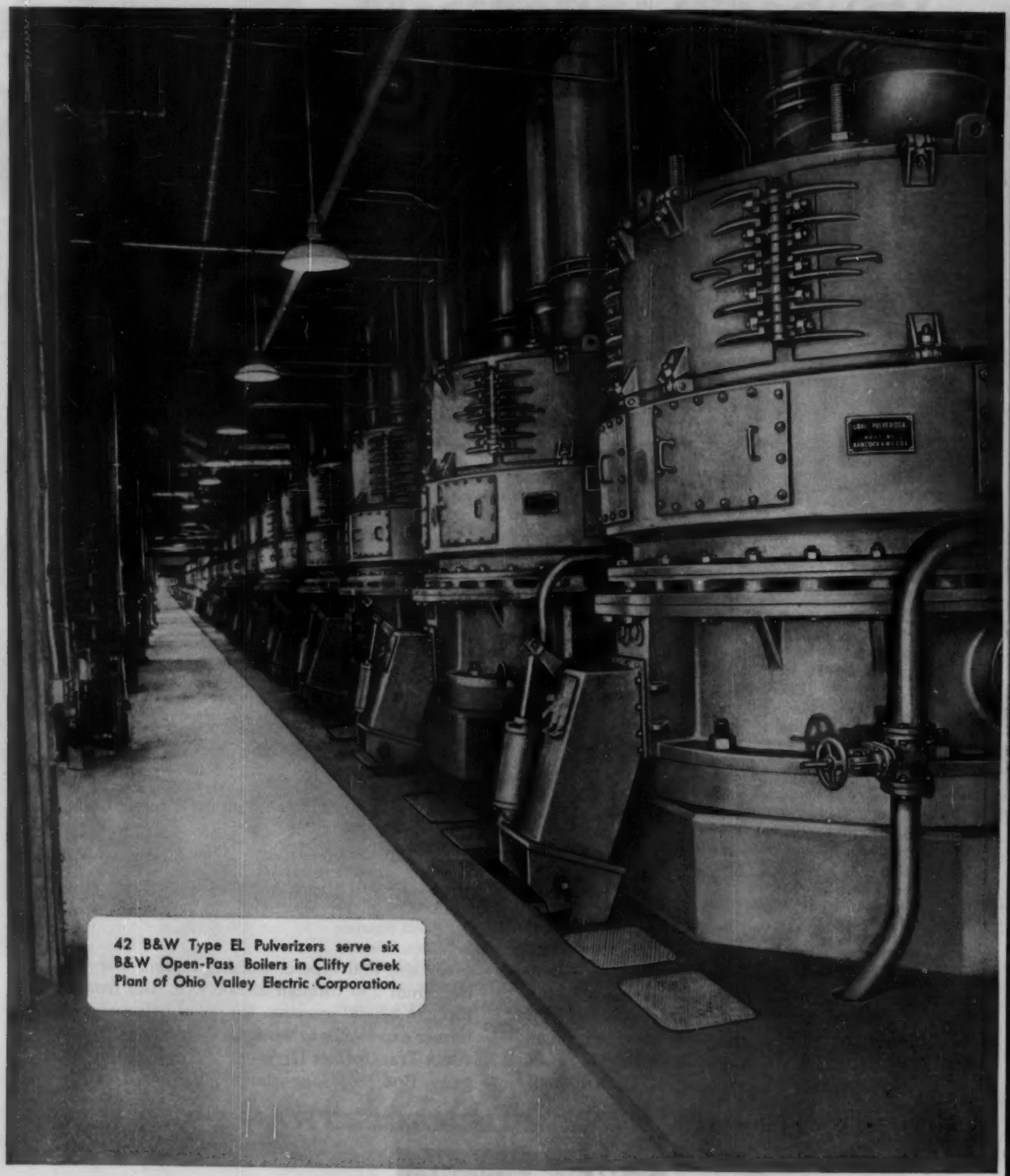
Only 20 calendar days were required to build and ship this 25,000-kva Pennsylvania Furnace Transformer. Even the *promised* shipping period of four weeks had looked like excellent service to the West Coast steelmaker—and by cutting this time by one-fourth, Pennsylvania saved the customer several days of costly downtime for the electric furnace involved. High voltage: 6,600 volts. Low voltage: 450 to 300 volts.

OF COURSE . . . it takes a lot of "everyday" know-how to accomplish the unusual with furnace transformers. Pennsylvania has established a nation-wide reputation for tackling and solving the most difficult problems in this highly demanding field . . . and not-so-incidentally, has designed and built virtually every size and type of furnace transformer now in use: from 250 through 25,000 kva, and from 3175 through 82,000 amperes. To put this furnace transformer experience to work for you, contact Pennsylvania Transformer Division, McGraw-Edison Company, Box 330, Canonsburg, Pa.

PENNSYLVANIA pt PENNSYLVANIA TRANSFORMERS **FURNACE TRANSFORMERS**

McGRAW EDISON

Have You Investigated
THE MODERN B&W



42 B&W Type EL Pulverizers serve six B&W Open-Pass Boilers in Clifty Creek Plant of Ohio Valley Electric Corporation.

DIRECT-FIRING SYSTEM?

A Compact, Space-Saving Package of Efficient Grinding Power

More power and capacity in a compact arrangement . . . long-range dependability . . . reduced operating cost — these are the measurable results of continuous, intensive development of the modern B&W Pulverizer. It has established an outstanding production and efficiency record in thousands of commercial installations. Here are some reasons why:

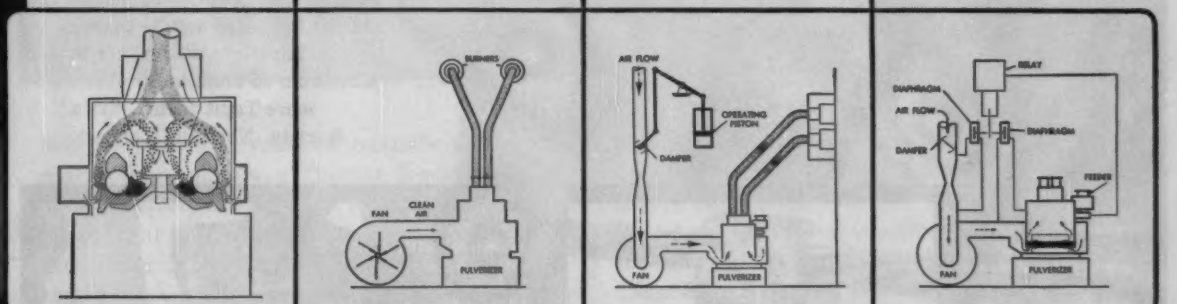
Continuous High Fineness Over Entire Service Life: Efficient combustion requires high fineness at all times. The high circulating load of the B&W Pulverizer permits efficient and dependable classification of product, so that only material of proper fineness leaves the unit. In addition, its slow-speed, spring-loaded ball bearing grinding elements maintain proper grinding contact throughout their service life.

Handles Wide Variety of Low Grade and Wet Coal: Regardless of the coal's grade or whether it's dry or soaking wet, the B&W Pulverizer's unique and exclusive recirculation of fuel through heated air assures efficient grinding . . . eliminates shutdown, capacity loss, or special attention from operators.

Simplicity of Arrangement and Reduced Maintenance: Accessibility for all normal maintenance makes it simple, quick, safe and low-cost. Adjustments are easily made while the unit is in operation. Using only clean primary air supplied under pressure, fan maintenance is substantially reduced and fuel piping is greatly simplified. Also, with the pulverizer acting as its own distributor, no special distributing devices are needed. Grinding elements are of special alloy material. They last two years or more on eastern coals and at least a year on midwestern coals.

Adaptable to All Types of Automatic Controls: Because it features "one point contact with the boiler," operation of the B&W Pulverizer is simple. The boiler's automatic combustion control is connected to the pulverizer at only one point—the damper in the primary-air duct. The pulverizer's own control system regulates all other functions, such as maintenance of proper fuel-air ratio and operating temperature.

SEND FOR DATA. For full information about the B&W Type EL Pulverizer and Pulverized-Fuel Firing Systems, write: The Babcock & Wilcox Company, 161 E. 42nd Street, New York 17, N. Y.



COAL RECIRCULATION — this means high fineness, aids drying.

PRESSURE SYSTEM — this eliminates fan wear, simplifies piping.

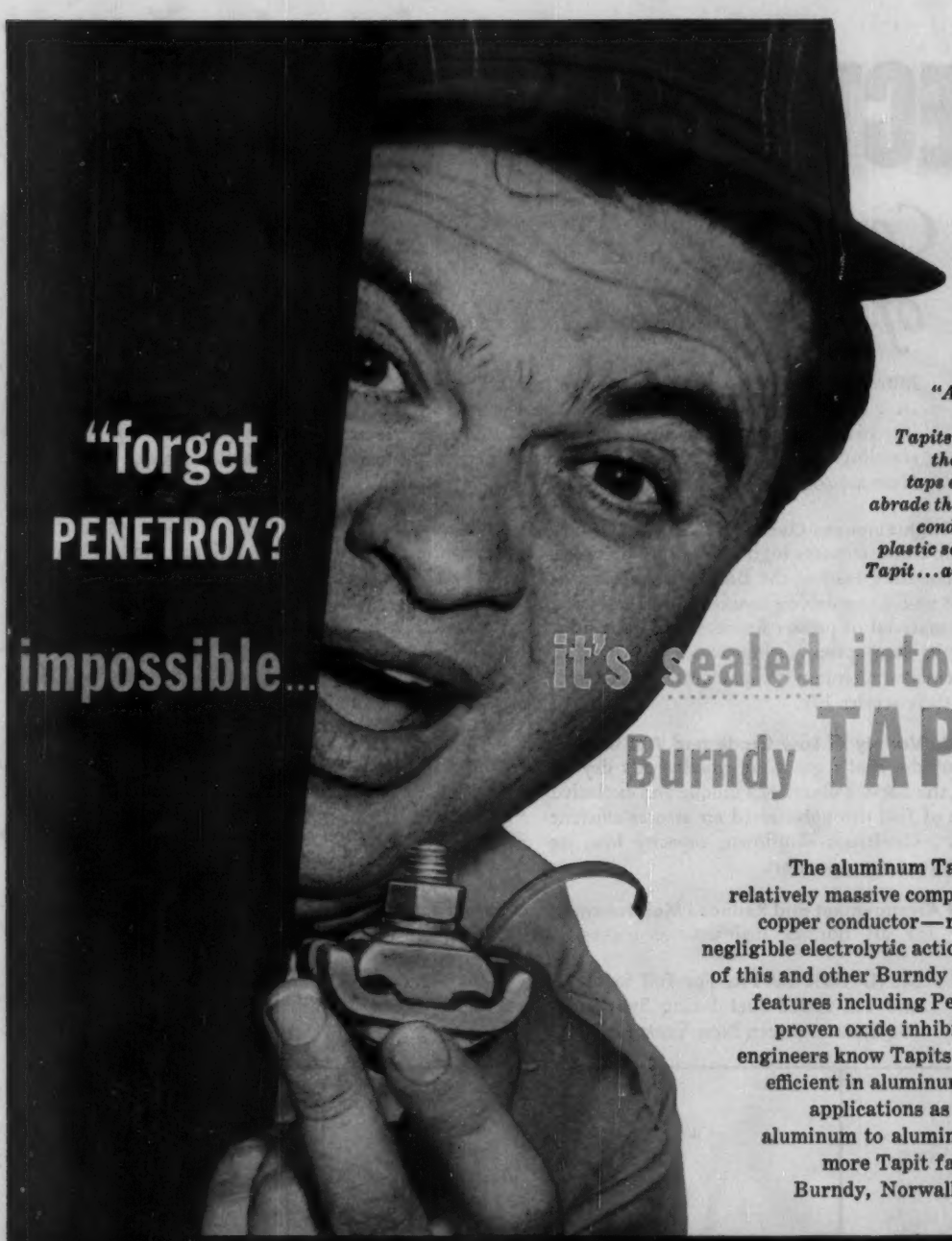
AIR CONTROL—this means one, simple control contact point.

MILL LEVEL CONTROL — this automatically adjusts fuel-feed.

BABCOCK & WILCOX

BOILER DIVISION

G-766



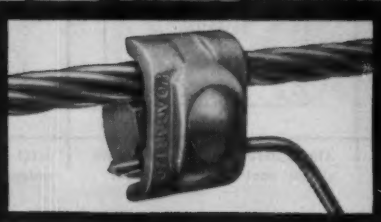
"forget PENETROX?

impossible... it's sealed into the Burndy TAPIT!"

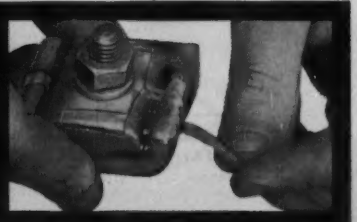
"Any lineman who uses Tapits will tell you they make line taps a cinch. Just abrade the aluminum conductor, strip plastic seal from the Tapit... and install!"

The aluminum Tapit body is relatively massive compared to the copper conductor—resulting in negligible electrolytic action. Because of this and other Burndy engineered features including Penetrox, the proven oxide inhibitor, utility engineers know Tapits are just as efficient in aluminum to copper applications as they are in aluminum to aluminum! Want more Tapit facts? Write Burndy, Norwalk, Connect.

Cathodic copper conductor is small compared with large anodic aluminum. Tapit—electrolytic current density on Tapit surfaces is reduced... corrosion effects are negligible.



Burndy Tapits are pre-filled with oxide-penetrating Penetrox and totally sealed in a leakproof plastic sheath. Opens fast with pull of tab!



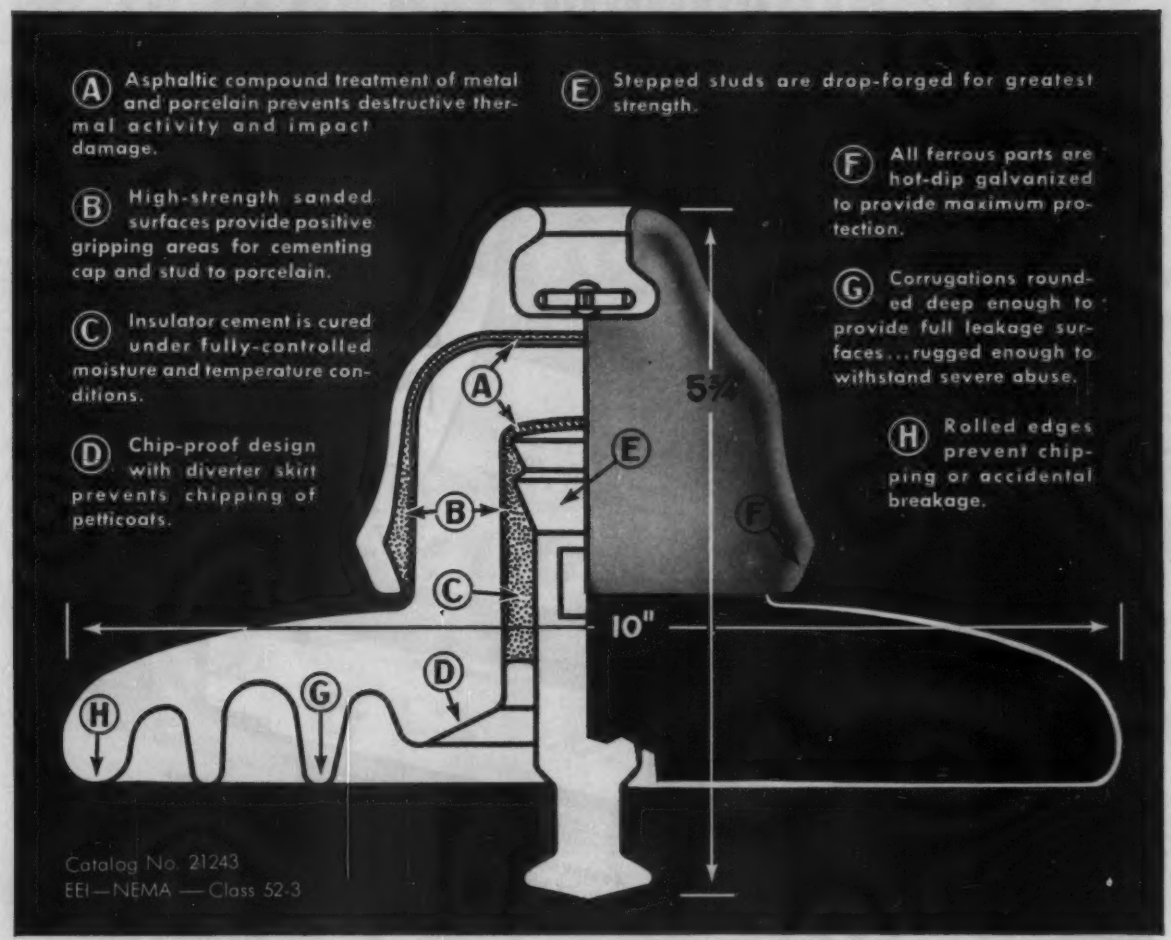
BURNDY

57-18

NORWALK, CONNECT., SCARBORO, CANADA

Custom-Built Thomas Insulators meet severest requirements

CHECK THESE FEATURES


(A) Asphaltic compound treatment of metal and porcelain prevents destructive thermal activity and impact damage.
(B) High-strength sanded surfaces provide positive gripping areas for cementing cap and stud to porcelain.
(C) Insulator cement is cured under fully-controlled moisture and temperature conditions.
(D) Chip-proof design with diverter skirt prevents chipping of petticoats.
(E) Stepped studs are drop-forged for greatest strength.
(F) All ferrous parts are hot-dip galvanized to provide maximum protection.
(G) Corrugations rounded deep enough to provide full leakage surfaces... rugged enough to withstand severe abuse.
(H) Rolled edges prevent chipping or accidental breakage.
5¾
10"
Catalog No. 21243
EEI—NEMA — Class 52-3

Wherever service conditions make the severest demands on insulators, a Thomas Insulator always gives complete assurance of satisfactory performance. That is particularly true of the insulator illustrated. It is designed and custom-built for installations where physical ruggedness is as important as insulating effectiveness. It fully meets all standard requirements for insulators of its type and capacity. It embodies all the tested refinements of construction and design which assure longer service life and superior performance. Write today for free data sheet. Address Thomas Works, Delta-Star Electric Division, H. K. Porter Company, Inc., Lisbon, Ohio.

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Divisions of H. K. Porter Company, Inc.: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.

Here's Why Square D's New Adjustable

ALUMINUM FEED-IN DUCT

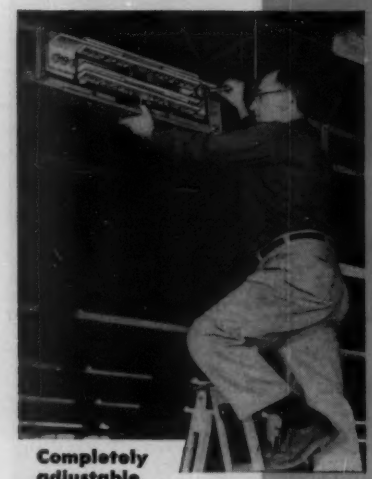
makes a lot of sense to me!

Needed-Rush!
85 feet; 3½ inches
1000 Amp, 3Ø4 wire
Feed-In Duct

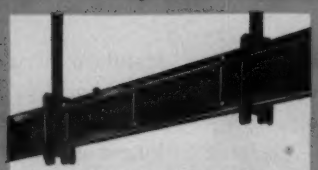
Telescoping joints with multiple slots permit infinite adjustability up to 12 inches when other than standard lengths are required. Standard elbows, T's and X's telescope up to 6 inches!

Fast delivery because any length requirement can be met with standard 3, 5, 7, or 10 foot lengths, plus telescoping joints

Faster to install • Above photo of fixed joint shows simplicity of design — symmetrical ends — less bars per phase — fewer connections — outward-facing captive bolts



Completely adjustable after it's hung. For example, if two ends terminate 6½ inches apart, connection can still be made with a telescoping joint



Totally enclosed for safety —at no price premium. No de-rating necessary. Square D's design eliminates need for ventilation

MORE DESIGN FEATURES

✓ Thinnest cross-section available! Tight spots, pipes and structural members present less problems

✓ Easy transposition of phases, using standard telescoping joint parts, for maintaining balanced voltage on long runs

✓ Certified short circuit tests by an independent testing laboratory have proved the superiority of Square D's continuously-supported bus design

Write for the complete story
Address Square D Company, 6060 Rivard Street, Department SA, Detroit 11, Michigan

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE

SQUARE D COMPANY

PREFORMED ARMOR-GRIP SUSPENSION UNITS provide a

Pretty Soft Life for a Conductor

. . . cradled in durable neoprene

No vibration fatigue here. The Preformed Armor-Grip Suspension Unit (AGSU) eliminates failure by eliminating stress concentration.

The conductor is cushioned in a split neoprene core, held securely by Preformed rods that never lose their tight grip, and supported in an aluminum housing. Conductor is protected and longitudinal stresses are distributed through the entire length of the rods—not at one point.

Like other Preformed line accessories, the AGSU obsoletes bolted hardware. It's easier to apply (no tools needed), costs less, does a better job. You get mechanical strength and electrical protection, and—because of the smooth contour and large diameter of the rod ends—corona emission and radio influence are minimized.

Want to know more about the Preformed Armor-Grip Suspension Unit—or see the application demonstrated? Write PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland . . . in 10 years the leading manufacturer of armor rods, dead ends, Guy-Grip dead-ends and other line accessories.

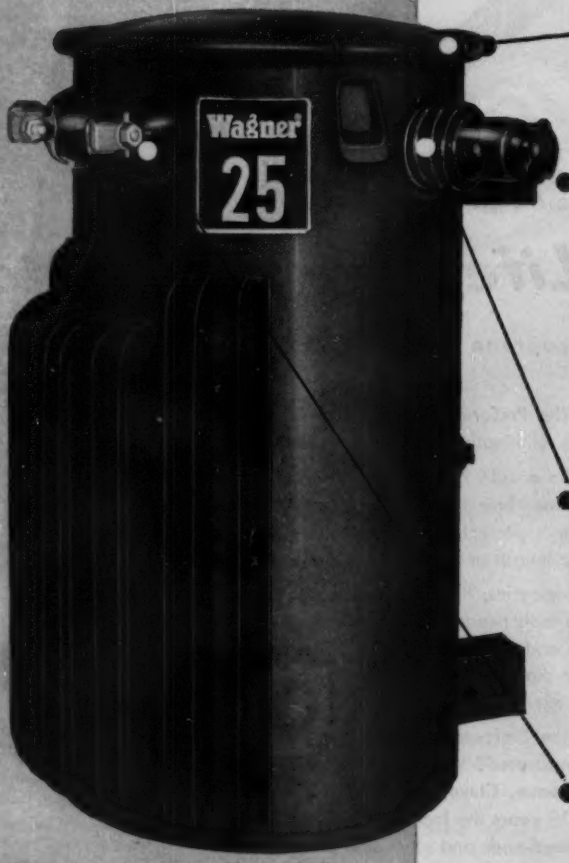
PLP

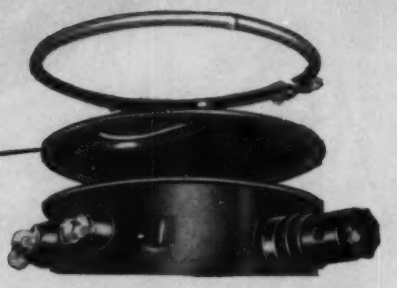
You can look up to **Preformed**

Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.

WAGNER FORM W Pole Type

offer all the mechanical you need for EASIER INSTALLATION...





SHUR-SEAL CLAMPING RING
Sealing gasket, held in place by retaining ring on cover, is uniformly compressed around entire circumference. Keeps transformer sealed air tight . . . no atmospheric moisture or dust particles can get inside. "Breathing" is completely prevented. Yet the cover may be easily removed by loosening a single bolt.

HIGH VOLTAGE SIDEWALL BUSHING
Permits the use of either copper or aluminum conductor. Insulating knob is designed for safer, faster, easier connections, without tools. Porcelain and terminal are locked in position.

LOCKED LOW VOLTAGE BUSHING
The bushing and terminal are key-locked to prevent turning when terminals are tightened. Eliminates loose terminal connections that could cause internal short circuits. Takes either copper or aluminum conductor.

Wagner maintains a nationwide organization to provide fast convenient service, with branches in 32 principal cities.

Bulletin TU-141 gives complete information on Wagner Distribution Transformers. Write for your file copy today.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

ELECTRIC MOTORS • TRANSFORMERS

DISTRIBUTION TRANSFORMERS

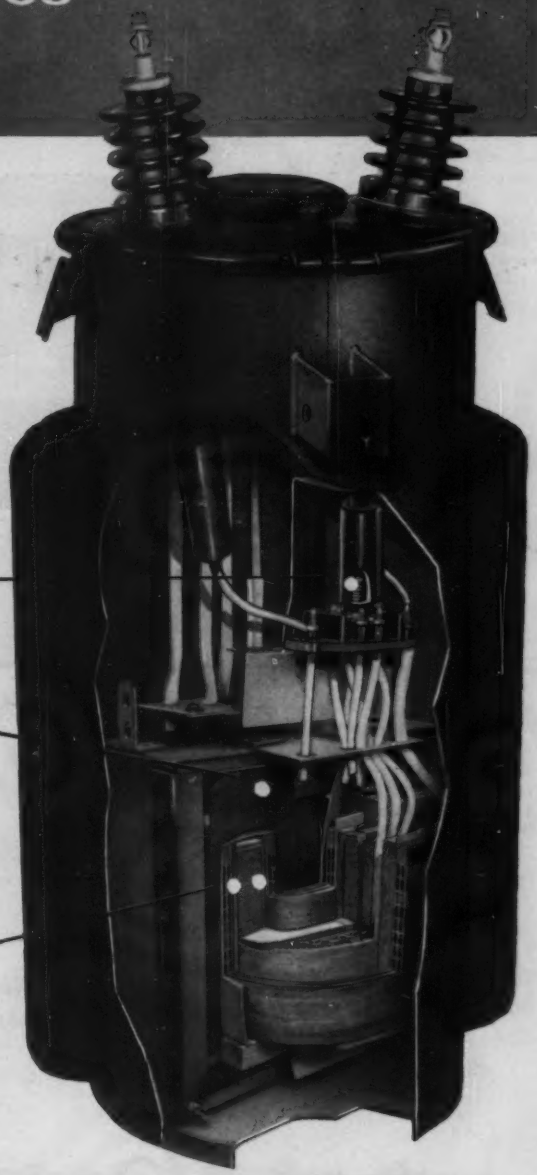
and electrical features

LONGER SERVICE LIFE!

Wagner Form W Distribution Transformers are exactly right for modern distribution systems. Their small size and light weight make them easy to handle—to store—to mount on poles.

Form W Transformers come in a complete range of single-phase ratings, 500 kva and smaller, 69 KV and below. All Form W Transformers, in ratings 3 through 167 kva, 15 KV and below, are designed for pole mounting.

You can choose either conventional or protected type Form W Transformers for your distribution lines with full confidence that they will pay dividends in longer service life.



ROTARY TAP CHANGER

Positive action . . . pre-loaded spring maintains constant pressure between the moving contact and the tap studs.

FORM W CONSTRUCTION

CORES are of cold rolled oriented grain transformer steel, cut into two turn sections, which are assembled through and around the coils.

COILS are wound of pure copper wire or strip, with high dielectric insulating material between layers in the high and low voltage windings. Insulation has crimped edges to hold windings accurately in place to permanently maintain electrical clearances.

BONDED INSULATION

An improved thermo-setting material for layer, channel and barrier insulation is bonded to the coil conductors to give the coils great mechanical and electrical strength.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

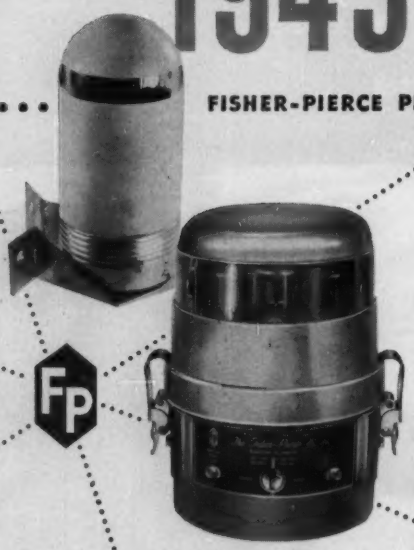
Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

T57-3

INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

1945

THE FIRST . . . **FISHER-PIERCE PHOTOELECTRIC LIGHTING CONTROL**



. . . THE LATEST

1957

The year World War II ended, The Fisher-Pierce Company began work with utility engineers to develop photoelectric controls. Automatic, dependable switching of street lighting circuits when illumination was needed, regardless of time of day, season or weather, was the fundamental idea. The Series 61300 was the first of five different, major groups of F-P controls that have followed.

The experience has proved valuable to Fisher-Pierce and customers alike. Backed by an organization of more than 650 people, F-P today offers photoelectric lighting controls for all purposes . . . extensive sales and engineering services . . . research, development and production facilities to solve specific photoelectric/electronic equipment problems you may have. Your inquiry about F-P products, who uses them, and how you may use our development facilities for your own electronic equipment requirements, is welcomed.

THE FISHER-PIERCE CO., INC.

82 PEARL STREET, BOSTON 85, MASSACHUSETTS

ELLIOTT
Fabri-Seal
INSULATION

not one insulation failure in 8 years...

ELLIOTT'S VACUUM PRECONDITIONING and PRESSURE IMPREGNATION assure trouble-free insulation

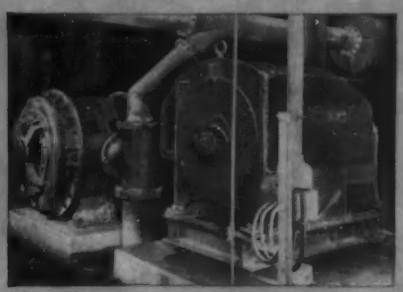
vacuum preconditioning

. . . is an important step in the new Elliott Fabri-Seal insulation process for large motor coils. This vacuum-pressure method insures thorough penetration of varnish into the innermost recesses of the wrapped coil. Every Elliott coil for squirrel-cage induction motors (600 v through 4800 v class) is placed in a tank, which is sealed and evacuated. This removes all air and moisture from within the coil.

pressure impregnation

After the preconditioning treatment, and while the coils are still under vacuum in the sealed tank, especially-formulated insulating varnish is pumped in. This combined vacuum and pressure procedure assures deep penetration of the varnish into the coils. This final baking produces a flexible varnish film which—should the need arise—permits coils to be removed from the stator slots without damage.

1,900,000 HP of induction motors...
with Elliott Fabri-Seal insulation are in operation in 42 states and 14 foreign countries. One of these Elliott squirrel-cage induction motors is seen below. Since 1948—when Fabri-Seal insulation was first used—not one such stator coil has failed due to insulation breakdown.



the result

. . . with Elliott Fabri-Seal insulation . . . the coil is completely sealed—providing positive assurance of the high strength and long life required to withstand the most rigorous operating conditions. For further details, write Elliott Company, Ridgway, Pa.

ELLIOTT Company

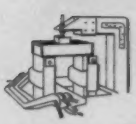
R7-50

FIVE OTHER REASONS WHY ELLIOTT "FABRI-SEAL" INSULATION INSURES LONGER SERVICE LIFE

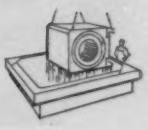
IMMERSION-TEST EVALUATES COIL LONGEVITY

MYLAR®-BACKED MICA SEALS COIL SLOT SECTIONS

SEALED AT ALL VULNERABLE POINTS



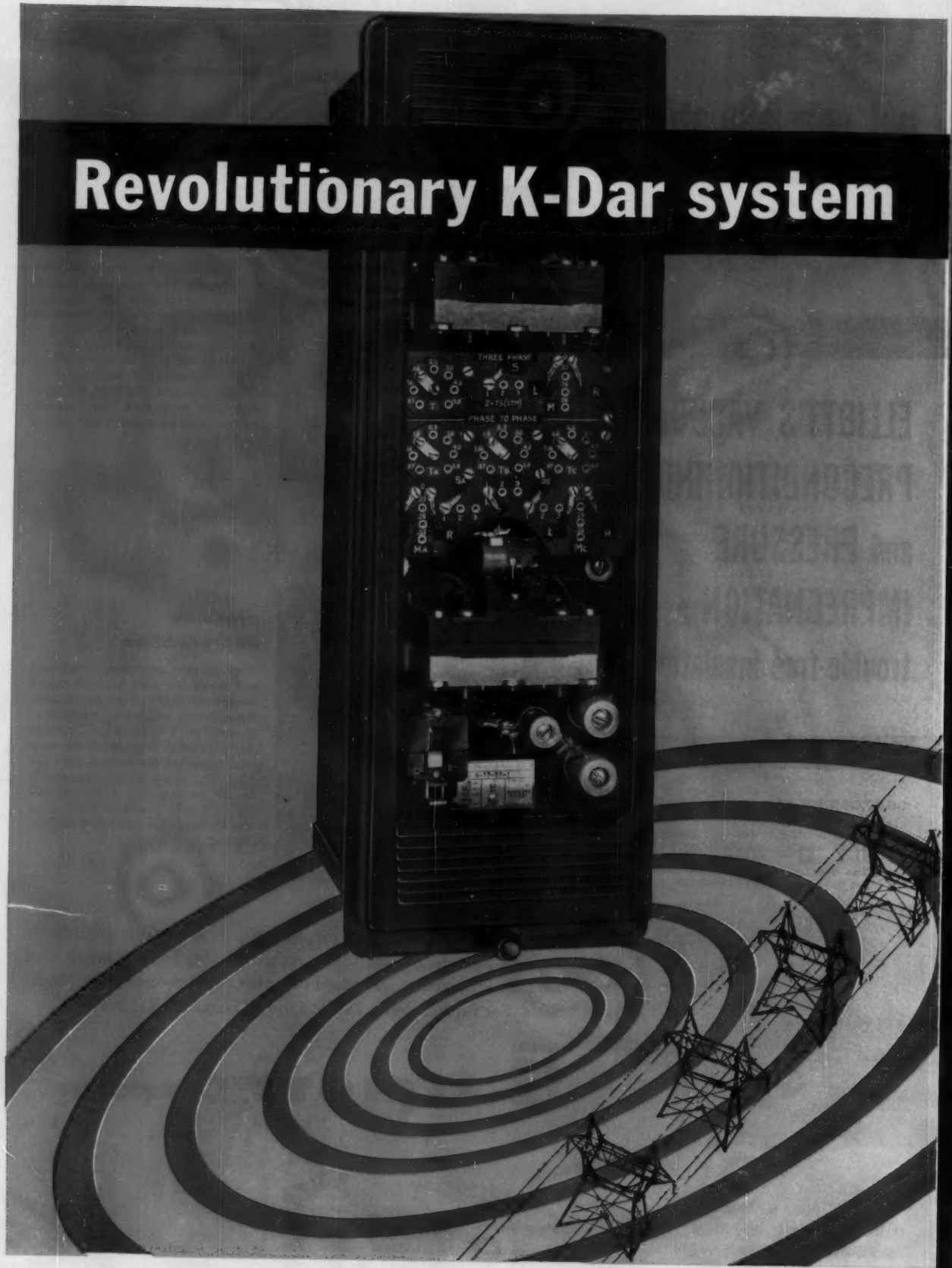
TURN-TO-TURN TESTED AT HIGH SURGE VOLTAGES



EVERY STATOR IMMERSED AND BAKED

*Dupont trademark

Revolutionary K-Dar system



. . . a NEW relaying principle

Transmission line phase fault protection using compensator distance relays

Relays making up the new K-Dar system provide high-speed protection of transmission lines from three-phase and phase-to-phase faults. K-Dar provides high-speed coverage of 90% of the line section with adjustable time-delay back-up of adjacent line sections . . . or provides simultaneous tripping of circuit breakers on a faulted section as a part of a carrier or micro-wave scheme.

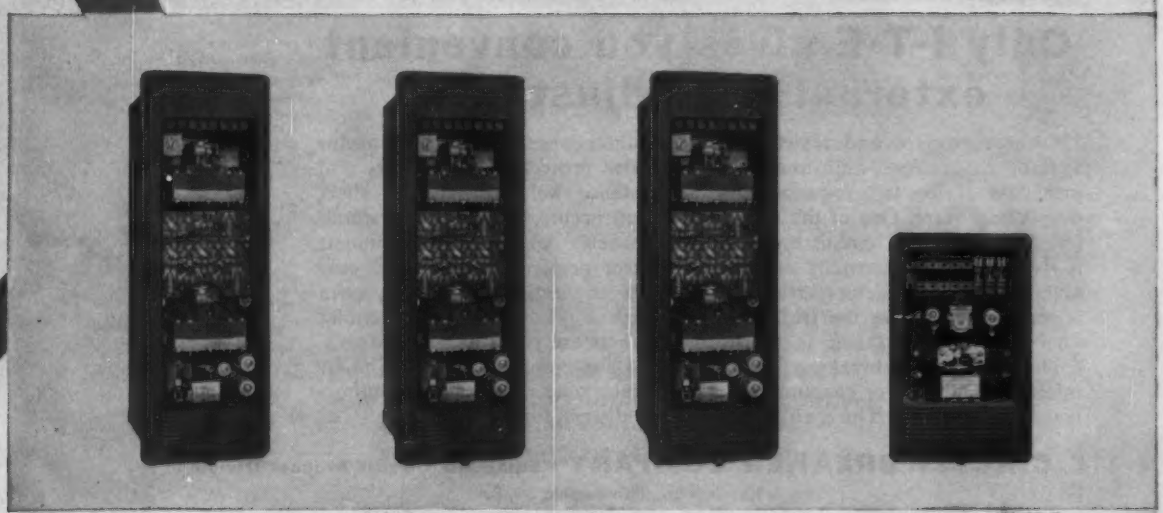
K-Dar is insensitive to transients . . . provides more accurate response to relay settings. Air gap compensators provide effective transient shunt. More reliable response permits relay setting to achieve greater line coverage.

K-Dar phase-to-phase relay unit operates independent of load current . . . Phase-to-phase settings can be made to reach further out on a line section because relay unit operates independent of load current or system-swing conditions.

K-Dar features simplified design . . . Low maintenance with K-Dar . . . few moving parts. With few adjustments, relay setting is much easier . . . testing is reduced to a minimum.

For complete information about the new K-Dar system, call your Westinghouse salesman. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-40500

YOU CAN BE SURE...IF IT'S Westinghouse



Four relays in K-Dar system provide complete terminal protection

MOLDED CASE CIRCUIT BREAKERS

Magnetic only type ETI circuit breakers have convenient, externally located adjustment controls. Available in F, J, K, KL, L and M frame (3 to 800 amperes continuous ratings), 2 or 3 pole, 600 v a-c, 250 v d-c.

Only I-T-E gives you convenient external trip adjustment

In motor control and resistance welding applications, adjustment of protective devices to a required setting is important. One of the many features of the ETI circuit breaker is its convenient externally adjustable magnetic trip device. When it is required to adjust the trip to a finer degree, adjustment is made from the front of the breaker without interrupting service or encountering live conductors. The range of instantaneous trip adjustment means greater protection for motors and resistance welders. When a short circuit occurs, all poles open simultaneously. And enclosed terminals protect personnel, yet permit easy cable connections. All these extra values in I-T-E molded case circuit breakers are yours at no extra cost. Send for complete information or contact your nearest I-T-E authorized distributor.

I-T-E CIRCUIT BREAKER COMPANY • **Small Air Circuit Breaker Division**

19th & Hamilton Sts., Philadelphia 30, Pa.

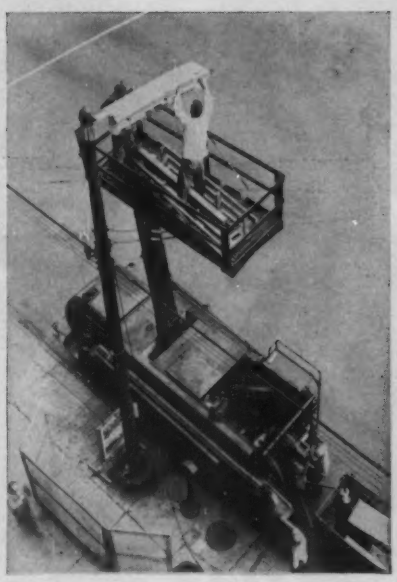
IN CANADA: EASTERN POWER DEVICES, LTD.

TOPS IN TOWERS

Holan 5-Section Towers give you high-up stability and safety, glide up smoothly with push-button platform control

44 SQUARE FEET OF WORK SPACE 30 FEET IN THE AIR. Crew members, working on 4′ by 11′ Holan tower platform, install fluorescent lighting in downtown Cleveland. The 96-pound luminaire is raised to exact position with tower controls.

5 TELESCOPING BOX SECTIONS extend with the five telescoping cylinders that lift the Holan tower into the air. Result: maximum strength, stability and safety . . . and a smooth ride up. Platform equipment includes push-button controls for raising and lowering, a handle for rotation and a 3-foot safety railing. Everything folds neatly over the body for stowage. Holan's 5-section design permits installation of tower behind the cab on *any* chassis even though transmission might extend beyond rear of cab. Rotary, transverse and stationary towers are available—17′, 23′ 6″, and 30′ maximum heights.



J.H. HOLAN CORPORATION

4100 WEST 150TH STREET
CLEVELAND 11, OHIO

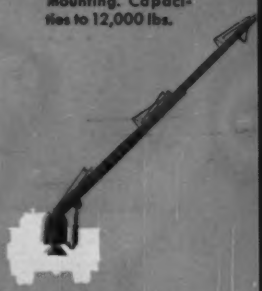
OTHER PLANTS: **HOLAN CORPORATION OF GEORGIA**, Griffin, Ga.
J. H. HOLAN CORPORATION, PHOENIX DIV., Arizona
BRANTFORD-HOLAN LIMITED, Brantford, Ontario

THE NAME THAT MEANS WORK SIMPLIFICATION

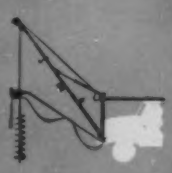
Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Service bodies for chassis up to 1½ ton. Lengths, 72″, 75″, 84″, 90″ and 102″.

Hydraulic Derricks designed for front or rear mounting. Capacities to 12,000 lbs.



Ladders to 40′ with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.



Portable hydraulic and mechanical earth borers. Augers for 8″ to 20″ diameters, depth to 8′.

Aerial arm for spotting workmen 37 feet above ground, 9 feet below ground level. Double-basket unit extends 45 feet. Rotates 360°.

EACH LINE MATERIAL TRANSFORMER is issued an IBM card upon which are placed all test results and reference information pertinent to the unit. Cards are microfilmed as a permanent record.

How L-M's Quality-Control System Insures High Transformer Standards

By **ROBERT P. THOMPSON**
Manager of Engineering
Transformers
Line Material Industries

Performance characteristics of L-M Round-Wound® transformers are outstanding. Physical features are exceptional. Quality is *built in* to L-M transformers, not tested in. To make doubly sure of maintaining uniformly high quality, L-M has established a very tight quality-control system.

Continuous tests are made—from raw materials to finished product. A final assurance of quality is the permanent microfilmed record of test information kept on every L-M transformer.

CORE TESTING: The tolerance permitted in testing the bare core of L-M's Round-Wound transformer is much more stringent than required by NEMA and ASA of core performance in the completed transformer.

The specially trained craftsmen who make Round-Wound transformers take pride in the high quality of their work—no small contribution to the continued excellence of Round-Wound transformers and their amazingly low failure rate—less than 2/10 of 1 percent!

Check on Incoming Materials

All raw materials and parts for L-M Round-Wound transformers are rigidly and systematically inspected. For example:

- Every high-voltage porcelain bushing is subjected to acceptance dielectric tests.
- Samples of all wire are tested for resistance and cross-section uniformity; coating is tested for dielectric strength, adherence, thickness.
- The cold-rolled oriented silicon steel used in making L-M's wound core is tested for physical and magnetic characteristics by means of a precision Epstein tester. Rigid standards on the loss and permeability characteristics are maintained.

In-Process Tests

A continuous "in-process" testing and inspection program is followed throughout the plant. Cores are tested for magnetic characteristics before and after copper coils are wound upon them. Coils are checked for ratio and given a mechanical inspection immediately after being wound. All finished units are thoroughly tested for leaks.

COIL RATIO TEST: Ratio and polarity are checked immediately after the coil is wound, so as to maintain close surveillance of the coil-winding operation at all times.

When the unit is completed, every transformer is given a complete series of electrical tests in strict conformity with NEMA and ASA standards. These tests include core loss and excitation current, copper loss and impedance, ratio, induced voltage, high potential, polarity, and impulse.

Certificate of Test

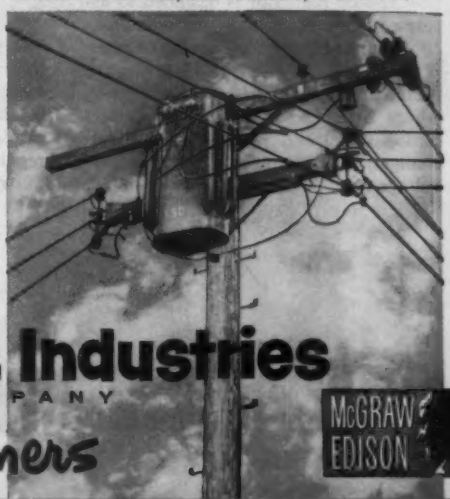
Each transformer is issued an IBM card which follows the unit through to completion. The card provides space for all test results. It is punched or filled in at each inspection and test station if, *and only if*, the transformer satisfactorily meets all the requirements of NEMA standards and of the L-M engineering and quality-control departments.

When the transformer is shipped, the cards are microfilmed and then stored to provide actual test data throughout the life of the transformer. This complete test information can be furnished to you at any time on any transformer.

Compare L-M's high standards of performance and outstanding physical features with other transformers; you will see why more customers are specifying L-M Round-Wound transformers.

Get Complete Information

Ask your L-M Field Engineer for complete information on the outstanding performance characteristics of L-M Round-Wound transformers and on L-M's unique obround tank. Or write Line Material Industries, Milwaukee 1, Wisconsin.



LINE MATERIAL Industries
McGRAW-EDISON COMPANY
Transformers

McGRAW EDISON

L-M's New 32-Step Regulator Combines All Desirable Features in One Unit... Plus:

- **reliable, accurate regulation**
- **smooth tap changes, long life**
- **ease of installation and maintenance**

by **N. K. DELANEY**
Product Manager, Capacitors and Regulators, Line Material Industries

Line Material has designed into one compact, efficient regulator all the desirable features found in all other standard makes—plus a few L-M "exclusives."

Sensitive Voltage Control

L-M uses an induction disc-type contact-making voltmeter for reliable, accurate voltage control. The unit is very sensitive, and easily adjustable to a band width of from plus and minus ¾ to plus and minus 6 volts. An integrated time-delay device is used to control the tap-change operation. The time delay can be adjusted independently on both "raise" and "lower" through a range of from 10 to 120 seconds.

Maximum Contact Life

The tap-changing mechanism on L-M's new 32-step regulator is designed to assure smooth operation and maximum contact life. The speed of the tap changer is hydraulically controlled to assure minimum arcing. This, plus a reactor which bridges across adjacent taps during operation, permits smooth tap changes, without current interruption or voltage dip.

Easy to Inspect

The complete internal assembly of the regulator is suspended from the cover to simplify untanking for periodic inspection and maintenance. This desirable feature permits you to inspect all mechanical and electrical parts quickly and easily without draining oil or dismantling the unit.

Less Bending Moment On Pole

The L-M exclusive obround tank design makes the unit smaller, lighter, with shorter moment arm distance from the pole. The unit is easier to handle and install, and the design substantially decreases the total bending moment on the pole.

Greater Current Capacity With ADD-AMP Feature

It is possible to increase the load-carrying capacity of L-M's new regulator up to 160% of its normal rating by reducing the regulation to ±5%. The range of regulation can be reduced externally without de-energizing the regulator.

Get More Information

Ask your L-M Field Engineer for more information on L-M's new 32-step regulator—the regulator with all the best operating and convenience features available on any and all other pole-type regulators. Or write Line Material Industries, Milwaukee 1, Wisconsin.

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Bushings are corona-free, and are designed for minimum radio interference.

Moving contacts and arcing tips of stationary contacts are made of arc-resistant copper-tungsten alloy to assure long contact life.

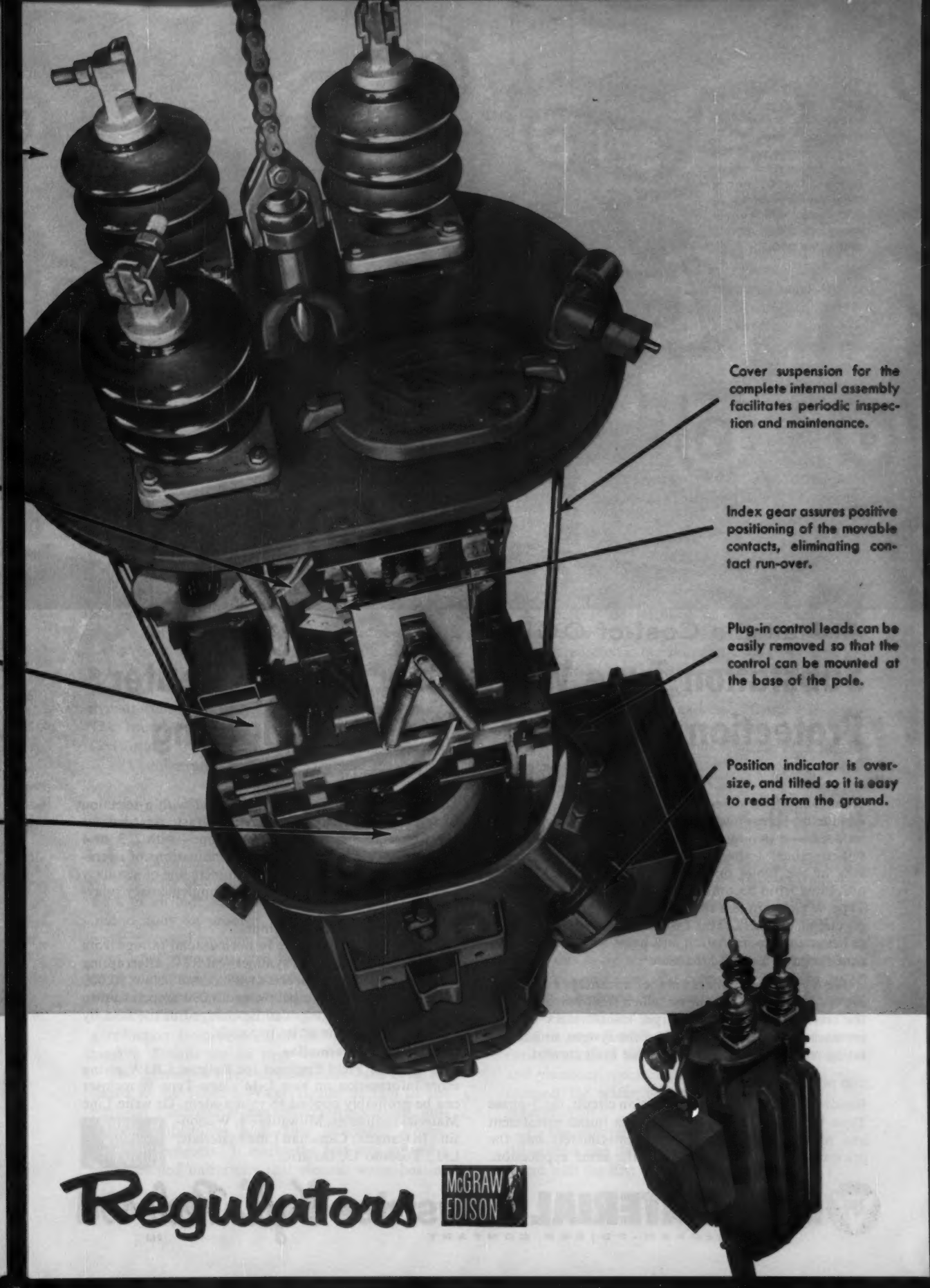
Bridging reactor provides smooth tap changes . . . no current interruption or voltage dip.

L-M's exclusive Round-Wound core-coil assembly provides a balance of low copper loss, low exciting current, and low core loss.

Available Ratings

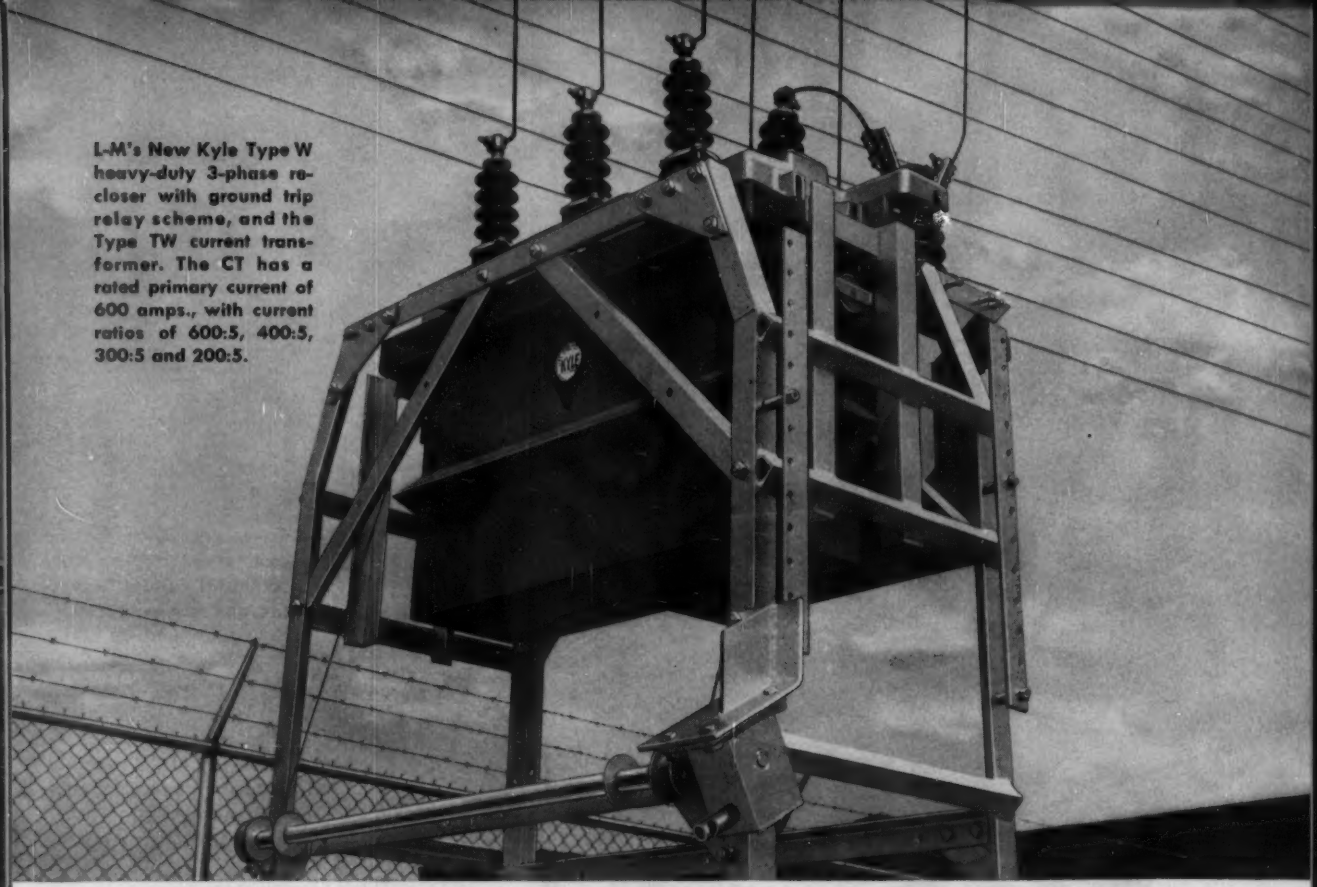
2500 volts . . .
100, 150 and 200 amperes
5000 volts . . .
50, 100, 150 and 200 amperes
7620 volts . . .
25, 50, 75, 100, 150 amperes

LINE MATERIAL Industries
McGRAW-EDISON COMPANY


Cover suspension for the complete internal assembly facilitates periodic inspection and maintenance.
Index gear assures positive positioning of the movable contacts, eliminating contact run-over.
Plug-in control leads can be easily removed so that the control can be mounted at the base of the pole.
Position indicator is oversize, and tilted so it is easy to read from the ground.

Regulators

McGRAW EDISON



L-M's New Kyle Type W heavy-duty 3-phase recloser with ground trip relay scheme, and the Type TW current transformer. The CT has a rated primary current of 600 amps., with current ratios of 600:5, 400:5, 300:5 and 200:5.

At Half the Cost of OCB's...

Substation Type W Recloser Gives Greater Protection With Fast 2½-Cycle Clearing

By **FRANK McSTAY**, Product Manager, Kyle Products, Line Material Industries

Now, with L-M's new high-speed Type W Recloser, conductor burn-down of distribution feeder circuits is reduced to a minimum. This completely automatic and self-contained 3-phase unit clears so rapidly that up to 90% of the faults on typical distribution systems are prevented from becoming permanent. In fact, the Kyle Type W clears in less than half the time of distribution oil circuit breakers. This instantaneous opening results in better fuse coordination and helps to confine permanent faults to a small area.

The Type W also offers another advantage: by reducing the length of time during which fault current flows, the recloser permits using larger transformers without increasing the size of the wire on the system, or necessitating reactors to limit the available fault current.

200 MVA for Half the Cost

Besides safeguarding the distribution circuit, the 3-phase Type W offers large savings in both initial investment and maintenance. The unit is approximately half the price of an equivalent OCB for the same application.

Series over-current tripping is utilized with a selection of five time-current characteristics—fast, retarded, or extra retarded—in two degrees of slope—with 2, 3, or 4 operations to lockout, in many combinations of operations. In addition, L-M has a complete line of auxiliary equipment to provide almost any supplementary relaying scheme.

Ratings from 100 to 560 Amps.

L-M's Type W is available in normal load ratings from 100 to 560 amperes, with symmetrical RMS interrupting ratings up to 12,000 amperes at 4.8 kv and below, 10,000 amperes at 8.32 kv and below, and 8,000 amperes up to 14.4 kv. Current ratings can be changed in the field by simply replacing the series trip coils.

Get Complete Information

Ask the L-M Field Engineer for Bulletin CRIW giving more information on how L-M's new Type W recloser can be profitably applied to your system. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

McGRAW EDISON

LINE MATERIAL Industries Kyle® Reclosers

McGRAW-EDISON COMPANY

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EDITORIALS

Is Russia Ahead in DC Transmission?

Reports on the progress of dc transmission research in Russia today suggest strongly that USSR engineers are abreast, but not ahead, of research elsewhere in Europe. Such reports (see page 62) may lead forward-looking transmission engineers in this country to ask the obvious questions: "Are we abreast of European progress in dc transmission?" "If not, why not?"

The simple truth is that the U. S. today is lagging substantially behind Sweden, France, England and Russia in dc transmission research.

The reasons are fairly obvious. In Europe the transmission problem is substantially different than in this country. Particularly in Sweden and Russia transmission distances range upward from 400 miles and the amounts of power to be transmitted are moderate. In the U. S., however, the problem is to transmit blocks up to 1,000 Mw for distances of 100 miles or so between terminals—a service within the demonstrated capability of 345-kv ac transmission.

It is not surprising then that we in the U. S. have not experienced comparable economic pressure to explore dc transmission. The high terminal costs of rectifier and inverter equipment puts the break-even point between ac and dc for straight-through overhead lines at 390 miles for 750 Mw and 320 miles for 1,500 Mw according to European authors. American economics may shift these points, but not enough to make dc competitive with 345 kv ac overhead.

However, the application of dc to underground transmission offers opportunities that are worthy of serious consideration in this country. Already one eastern utility is studying its future use in transmitting power from a large outlying power plant through the suburbs, into downtown load areas. For such situations, and for distances of upwards of 50 miles, underground dc transmission may well offer stern competition for underground ac circuits ten years hence.

Utilities Stick to Expansion Plans

Despite talk in general business circles of cutbacks and leveling off in capital expansion, electric utilities are holding firm to their plans for this year and next.

To check any last-minute shift in sentiment since our Electrical Industry Forecast earlier this month, Electrical World editors last week talked with executives of some 20 large utilities throughout the country. The roundup (see page 50) is solidly optimistic. Conclusions drawn from this spot survey:

1. Utilities are building at or near the budget levels set at the beginning of this year.

2. There is no intention of trimming expansion schedules for 1958. Spending will be at or near the amounts reported in our Forecast Issue (EW, Sept. 2).

3. Utilities have been trimming inventories as delivery schedules improve.

As might have been expected, there was some comment on inflation and rising prices. But there was nothing to contradict our forecast of a record construction year in 1958.

Water Heating: Simplify It to Sell It—III

That Gordian knot—electric water heating—is a bit closer to being unraveled today, thanks to the work of an independent industry committee organized to study the problem. This week the committee made its initial recommendation.

In brief, the committee has come up with a list of 10 water heater models and element combinations which it believes will satisfy the needs of 75% of the industry. These 10 electric water heaters represent a reduction from more than 200 currently on the market. Details are on page 49.

The committee's recommendations have been referred to the Electric Water Heater Section of the National Electrical Manufacturers Association, utilities, manufacturers and other interested groups.

This is progress: It marks the first step toward a much needed uniformity that electric water heating must achieve if it is to become an integral part of the residential load and get a realistic share of the market.

It now remains for each utility to examine these proposals carefully with a view to ultimately adapting them to its needs.

But this is by no means the end of the problem. In its announcement, the committee carefully noted that its recommended consolidation of water heater models was but one part of a three-part program. The group is now directing its attention to the remaining two. Studies are being made of the numerous wiring and plumbing specifications and of the various rates charged for water heating service throughout the country.

To the committee we wish as much success with the second and third strands of the Gordian knot as it had with the first.

To serve future residential loads, distribution engineers . . .

Select Higher Secondary Voltage

Higher secondary voltage for future residential loads was the majority choice among distribution engineers attending a recent distribution engineering conference sponsored by Westinghouse Electric Corp at East Pittsburgh, Pa.

But there remained disagreement over whether the system should be single or three phase.

Three Voltages Preferred

Preferences were expressed for 240/416 v three phase, 265/460 v three phase, and 240/480 v single phase. When advocates of retaining 120/240 v single phase assumed a higher secondary voltage as mandatory, opinions became equally divided between single and three-phase higher secondary systems.

These expressions of the form future secondary systems should take were formulated in a "group dynamics" method of resolving the residential distribution problem. In this method, distribution engineers from 37 utilities from all parts of the U. S. were grouped into five teams. Each team had the objective of answering these questions within one hour's time:

1. What is the best solution to the secondary distribution of power in new residential areas?

2. If a higher than 120/240-v secondary is the best solution, should this be single or three phase, and at what nominal voltage?

Conferees were thrown upon their own knowledge of the industry and its growth prospects, and their experience as design and operating distribution engineers. The problem was not qualified in any manner, nor were any general assumptions made for the five teams. As was pointed out before the session began, "The making of these qualifications and assumptions is in actuality the real problem distribution engineers face today." In brief form, these are the decisions, and the reasons for them, made by the five teams:

Team A—This group decided to answer No. 2 and then compare the higher secondary voltage with the present 120/240-v system. They assumed load values of 8,000-10,000 kwhr per residential customer per year, with load densities of 8,000-10,000 kva per sq mile. Their choice was a 240/416-v three-phase system.

It would be satisfactory to adopt this system immediately with linear secondaries; area coverage would follow. Existing distribution transformers could be wyed for this system. Three-phase primaries would have to be extended. Although this higher voltage is compatible with present appliances, forthcoming appliances would have to be designed for the higher line-to-line voltage.

The 240/416-v system was superior to the present 120/240-v system for future loads, in this team's opinion. They recommended going to the higher secondary in new areas, while maintaining the lower system in existing areas.

Team B—Going to a higher secondary voltage was the team's answer. The majority felt that coming higher loads (about 10 kva per house) will be too much for the present 120/240-v system. The team agreed future secondaries should be a 265/460-v three-phase, four-wire system.

This decision was based in part on the assumption that a number of utilization devices, which would contribute to the higher loads, would be three-phase devices. It was concluded that as the need for a higher secondary system arose, problems concerning appliances, conflicts with codes, metering, and safety could be solved satisfactorily. Most members felt that a 15-kv class voltage would be adequate to supply the higher secondary system.

Team C—Agreement was reached that the present 120/240-v system can handle loads up to 10 kva per residential customer, and could approach one transformer per pole

serving four customers. This voltage will offer fewer operating problems, no conflicts with present standards, codes, and safety considerations, and little difference in economics. It would also be compatible with higher primary voltages of 23 and 34.5 kv.

In assuming a higher secondary voltage as mandatory, this team selected a 240/480-v single-phase system. The area coverage principle should be applied only up to the use of the maximum kva transformer rating for pole mounting.

Team D—Several assumptions were made before No. 1 could be answered. These were that appliances were available at any voltage, that customers would buy the appliances (as against getting a home with built-in appliances), and that a completely new subdivision was to be served. The best solution then was a 240/480-v single-phase system. The higher voltage was based on better utilization of conductors, reduction in flicker and better regulation, and less installed transformer capacity due to greater diversity. Single-phase service was chosen because of expected construction difficulties with three-phase primaries, tree problems, appearance, and cost. Metering and lack of three phase in some areas were other factors.

Team E—With one exception, those who serve large (5-7½ hp) air conditioners felt three-phase supply was necessary to minimize motor-starting voltage dips. The exception serves such units satisfactorily using series capacitors. Team members without this problem felt the future system should be single phase for economic reasons. It was agreed a future dual standard would be desirable, with single phase used everywhere except in areas where a large saturation of central air conditioners is, or may be expected to be, served.

The majority felt that 120/240-v systems should be retained as standard, general-purpose secondaries. Foreseeable loads could be served satisfactorily, using a transformer on each pole if necessary. This majority felt the benefits of "area coverage", while theoretically substantial, would not be realized in practice. The problem of locating large transformers in residential areas would be formidable. Thus the principal advantages of the higher voltage might not be attainable.

Assuming a higher secondary voltage as mandatory, 240/480 v single phase was preferred, with the exception noted previously, where 265/460 v was preferred.

Top Ten Water Heater Models Chosen

Special study group selects models which may meet needs of 75% of the industry; proposed standardized list is sent to utilities and NEMA to determine acceptance

In a major step toward simplifying and standardizing the water heater, its manufacture and distribution, a special study group has just proposed a list of ten models which is believed to meet the needs of 75% of the industry.

Picked from Over 200 Types

The ten recommended models were chosen from among the more than 200 types now on the market. They would include four tank sizes and six combinations of upper and lower heating element wattages. The models would be available in four styles (see table).

To determine whether the proposed simplified list will be generally acceptable, the group has sent its recommendations to various interested groups. They include a large number of electric utilities and the Electric Water Section of the National Electrical Manufacturers Association.

The group responsible for drafting the recommendations is the Special Electric Water Heater Study Group, composed of representatives from electric utilities and water heater manufacturing firms. Led by Paul D. Brooks, vice president of the American Gas & Electric Service Corp, it worked independently of any official organization.

E. O. George, vice president of Detroit Edison Co, headed a subcommittee which conducted the studies involved. These studies, which examined returns on national surveys, resulted in the final recommendations.

The study group's recommendation is the first phase of three-point program. The others are:

- A study of the numerous electrical wiring and plumbing specifications which contribute to the manufacturers' problem.
- A study of the different electric rates applying to water heater service throughout the country. Chairman Brooks has pointed out that the extent to which electric rates contribute to the problem is really a matter to be studied by each individual utility. But he said the study group will work toward helping to solve this problem, because of the close relationship between reasonable rates and acceptance on the residential level.

As a service to both the utility and manufacturing industries, the group is now formulating plans to undertake a survey to determine the pattern of hot water use throughout the United States. It would concentrate on the hourly pattern of demand for hot water in the home, which has changed in recent years with increased use of automatic laundry and other equipment.

Simplified Models

Tank Size (Gal)	Model	Lower Element (Watts)	Upper Element (Watts)
30	Round	600	1000
40	Round	4500	4500
40	Table Top	4500	4500
40	Shell-Less	4500	4500
50	Round NEMA	1000	1500
50	Round	2000	4500
50	Table Top NEMA	1000	1500
50	Table Top	2000	4500
80	Round NEMA	1500	2500
80	Round	3000	4500

Construction Plans Hold Firm

- **Expenditures of 16 out of 18 electric utilities are 'on the button' or higher for 1957, EW's spot survey shows**
- **Spending in 1958 will be greater or about the same for 11 utilities. Those expecting a dip attribute it to completion of big job this year or expansion in 1959-60**
- **Inventory trimming seems to be the order of the day but some report stocks are above 1955-56 levels**

Regardless of the earnings picture, the price of equipment, or the high interest rates on borrowed money, electric utilities have to be ready to supply their commodity to all comers. This axiom in the U. S. power field served as the bedrock for answers to Electrical World field editors' questions on construction budgets last week.

A sampling of 18 representative companies and municipally owned utilities piled up convincing evidence that utilities will be spending at least as much as their 1957 budgets called for. The construction budgets are firm despite any "rolling readjustment" or all-industry leveling of capital expenditures. And 11 of the contacted utilities are planning budget requests for next year's projects that will equal or exceed expenditures this year.

The survey fully supports Electrical World's Forecast Issue (Sept. 2, p 91) which sets the industry's 1957 construction expenditures at a new high of $4.6 billion. Spending next year is expected to hit $5.3 billion.

Slight Distribution Lag

"We're right on the nose" for the '57 budget, an official of a large municipally owned utility told Western Editor Charles Hochgesang. Sixteen of the 18 organizations contacted replied in the same vein or indicated budgets were being exceeded. One company in the Southwest said there was a lag in its distribution construction mainly due to a drop in earnings that has deferred some improvements. The remaining dip amounted to about 2% for a company in the South that is experiencing some electric and construction manpower problems.

As for 1958, six utilities are virtually certain that budgets will be greater than this year. Five say that spending will be about the same. Of the other seven, three utilities are wrapping up big jobs now and consequently will budget somewhat smaller outlays in 1958. Another company accounts for a slight drop next year because of plans for major construction in 1959 and 1960.

The lag in housing starts and a relatively cool summer have had some impact on four systems' distribution outlays. One of these, a company in the Great Lakes region, told Midwestern Editor Edward Allen it had let some contracting crews go. Cool weather and poky housing construction has curtailed some purchases of distribution transformers and meters for a Southwest company. The remaining utilities said all transmission and distribution items were according to budgets.

No Slack in Generation

When asked about the outlook for turbine generator installations, all but one of the officials surveyed replied that no cutbacks are planned. "We have a big program that is going ahead as scheduled," said an executive of a large company in the East. One company may defer a unit to 1961 instead of 1960, but added that construction is right on schedule.

A more optimistic outlook for housing (EW, Sept. 23, p 119) is predicted for the next few years by observers close to the building industry. Population growth, replacement of old homes, and family unit relocations point to an upturn that may raise distribution budgets.

Eight of the utilities said that book prices are being paid for most items. The exceptions for four of these respondents was aluminum conductor. A large Midwestern company said it is receiving bids well below book prices on transformers and wire but no discounts on hardware or meters.

Noted a Mountain States executive: "Competition is lively despite book prices. The market seems to be returning to a competitive status not seen since before the war. We've had wide variations in bids, often reaching to substantial discounts from book or a dropping of long delivery escalator clauses to get business."

A West Coast municipal also noted varying bids but added, "This is not new." A neighboring company said that bidding spreads were noticeable to the first of the year "but now things have tightened up."

Impact of Inflation

A company spokesman told Middle Eastern Editor Frank Kovalcik that they are giving a little more attention to foreign sources at the investigative stage of a prospective purchase. The "built-in inflation" of the U. S. economy will see utilities searching around to get relief from climbing prices, he predicted.

Most of the utilities contacted are trying to work inventories down. And today's quick deliveries of many items is the big factor in the paring. Despite their efforts, though, eight of the 18 utilities find inventories somewhat above 1955-56. Bad weather, materials arriving ahead of schedule, and increased construction tempo were some reasons given for the gains.

Keeping Tabs on Stocks

Four firms said inventories are about the same as the preceding two years. Six had cut back anywhere from "slightly" to 15% below '55-56 levels.

A company in the South told David Rea, Southeastern editor, it finds a monthly IBM inventory provides better stock control. In the Midwest, a company cut off purchases about eight months ago when copper prices began their descent. Other utilities are specifying deliveries closer to needs, carefully reviewing stocks, and maintaining flexibility by shifting material between divisions.

Calectric's Carl C. Ernst Nears 'Permanent' Status

Hired as temporary electrician 37 years ago, the new president says his rise came because 'I never turned down a chance to do something new and different.'

Back in 1920 California Electric Power Co, needing a crew to install starters at its new pumping plants in the desert community of Victorville, Calif., assigned a gangling 23-year-old theater electrician to the temporary staff.

Today, 37 years later, the new president of Calectric, Carl C. Ernst, wistfully opines, "Maybe if I stick around long enough they'll put me on the permanent staff."

After the Tour, 'A 6-Yr High School'

Born in Hulington, Ohio, Ernst knocked around the country before graduating from Los Angeles Polytechnic, which he describes as "a six-year high school with some engineering courses thrown in."

After a World War I stint in the Army he attended the electrical engineering school at the University of California, and later signed on as an electrician at a Los Angeles opera house.

The year after he came to Calectric, Ernst was working as a lineman when he was appointed local agent in Barstow. A series of superintendent jobs followed. He then served as assistant district manager in El Centro, and later as district manager in Tonopah, Nev. In 1944 Ernst was brought into the general office as vice president and executive assistant. In 1945 he was moved up to vice president and assistant general manager. And the following year he became vice president and general manager, a position he held until his appointment as president this year. He succeeded Albert Cage.

He attributes his present position to the fact that "I never turned down a chance to do something new and different."

He doesn't pretend he made it alone, and is sincerely grateful to Calectric's founding fathers who theorized that management talent is best nurtured by "giving a man a job and letting him do it," a philosophy Ernst perpetuates wholeheartedly.

Ernst's admiration for the men who pioneered the company is unbounded. "They had tremendous foresight in developing the San Bernardino and Riverside metropolitan areas."

A $14-Million Gain Since '47

Reaching into his roll-top desk, Ernst extracts a couple of charts in support of his admiration. One shows a 222% population growth in the area since 1930 compared with a U. S. increase of 35%. The other traces Calectric's total electric revenue rise from less than $7 million in 1947 to more than $21 million in 1956.

A travel enthusiast, Ernst and his wife, Elizabeth, whom he married the year after he joined Calectric, often drive to see his daughter and two granddaughters in Whittier. They fly to Hawaii about once every two years to see another daughter and her four children.

Today Ernest hunts occasionally, plays 1/20th¢-a-point bridge, but mostly confines his recreation to "waving a hose twice very gently over the lawn once a week."

Keeping in Character

But it's the company that's his life and he admits it freely.

"Its got character," he says, "just as an individual has character. Despite hardships, Calectric didn't lay off a single permanent employee during the depression. Our employees like this company. That's character."

Of Calectric's 1,250 workers, 280 have been with the company for more than 20 years.

To large degree the new president is on a mutual first-name acquaintance with the office staff, linemen, division chiefs, and station employees.

Ernst is fiercely proud of the company's rise from serving a small mining camp in Nevada in 1905 to its current status of 10 hydro plants and two steam plants generating a peak load of 300 Mw. The company also owns a south-of-the-border utility—Industrial Electrica Mexicana.

He's also proud of the fact that Calectric is still using the two original 1,500-kw generators it began with in 1905. And it's not sentiment. "They can still do the job."

Long Grass-Roots Job Ahead

In a view of the industry as a whole, Ernst labels as the most serious problem the entry and expansion of government operations.

"Every time the government gets into the utility business it creates an unfair tax burden on the consumer. I think the industry has to do a thorough job of public education to make people realize this. I don't mean propaganda, I mean a long, gradual process of grass roots education. We didn't get into this mess in a hurry and we're not going to get out of it in a hurry."

However, Calectric's boss doesn't pretend to be a spokesman for the entire industry. His job, he says, is to make sure that when somebody flicks a switch the lights go on.

FPC HEARING BREAK finds AG&E Pres Philip Sporn, left, departing from group where John Burke (in bow tie), Pacific Northwest Power Co president, and Donald Cook (back to camera), AG&E vice president, discuss the developments

Utilities Ask: Why Change Rules?

Electric companies urge against changes in accounting methods for liberalized depreciation, accelerated amortization

Electric utilities have urged the Federal Power Commission to make no changes in its uniform system of accounts with respect to liberalized depreciation and accelerated amortization accounting.

The appeals came in a one-day hearing before the full commission on amendments which generally propose that:

- Utilities must place deferred taxes resulting from either accelerated amortization or liberalized depreciation in a special tax reserve.
- A utility taking liberalized depreciation must use vintage-year accounting for tax depreciation rather than the composite method used by most utilities.
- A special account be set up for tax deferrals other than those from liberalized depreciation or accelerated amortization.

Accelerated amortization permits a tax deduction over five years for amortization of facilities. This so-called rapid tax write-off has been cancelled now except for certain defense and atomic energy projects.

Liberalized depreciation, allowed under a provision of the 1954 Internal Revenue code, permits cost of the plant to be depreciated rapidly by such methods as the declining balance and sum-of-the-years digits instead of uniformly over the property life.

While gas companies generally raised no objections to the proposals, electric companies were opposed.

A. J. G. Priest of Priest & Reid, representing Edison Electric Institute and some individual electric companies, asked that no rule changes be made on grounds that state public service commissions are meeting the situation adequately.

Priest said he was not arguing the merits either of reserve accounting or restricted surplus accounting because EEI had a number of companies using both. Neither violates sound accounting principles but neither should be mandatory in a situation being met by state commissions, he said.

Beatty's Statements Challenged

Both Priest and Donald Cook, former Securities & Exchange Commission chairman and now executive vice president of American Gas & Electric Co, attacked testimony of F. M. Beatty, partner of Arthur Anderson & Co, nationally known accounting firm.

Beatty, whose company handles a number of electric utility accounts, said his firm favored deferred tax accounting and the proposed FPC regulation amendments. He proceeded to support his case from an analysis of 1956 annual reports of 175 gas and electric utility companies.

In this analysis, Beatty listed 17 companies which "reflected the deferred taxes in income and thus overstated net earnings by not recording deferred taxes."

Priest, following Beatty on the witness stand, said Beatty had gravely and seriously impugned the integrity of accountants who certified statements of the 17 companies.

If earnings had been overstated, he added, then the accountants in question had been derelict in their duty.

Cook was even stronger in his condemnation. If earnings were overstated then the 17 companies were in contravention of 1933-34 SEC acts, he said. Furthermore, these statutes contain both civil and criminal penalties, Cook declared. This situation would serve as a basis for barring the accountants, he said, who had certified these accounts from practicing before the SEC.

Cook Urges FPC Action

Cook urged that FPC get the names of the 17 companies, determine whether they had overstated their earnings, then pass the records to SEC to take further steps.

Philip Sporn, AG&E president, argued against the proposed rule changes and urged that the practice of keeping deferred taxes in surplus be retained. If these credits were reflected in a reserve, as proposed, it would be of no value as capital

structure and it would burden companies with added expense, he said.

You can't make available to consumers a deferral that has taken the form of an expense, said Sporn.

In response to a question from Commissioner William Connole, Sporn said, "It makes a great deal of difference whether the money that went into bricks and mortar is reflected in restricted surplus or in a reserve account. In the one case it serves as equity and supports additional debt. In the other case it does not serve as equity and the equity must be raised from investors. Equity is much more expensive financing than debt financing and that expense is borne by nobody else but the consumer," Sporn said.

FPC Assistant General Counsel John C. Mason, speaking for the FPC staff, urged adoption of the proposed changes. The staff favored reserve accounting because it would provide uniformity.

Mason said the staff did not see how money collected to pay a tax liability, whether present or future, could be permitted to become earned surplus and called equity.

Some had argued, he continued, that it seems to be equity to the investor. The investor should know what is equity and what is not.

Mason contended that if the credit is placed in surplus and there is no further reason to charge anything against it, then it becomes unrestricted surplus and might well be paid out in dividends.

It would be in the interest of consumers, investors, and ratepayers to have the money accounted for under a uniform system where everybody understands what it is and there is "no question about it, no footnotes needed," he said.

Mason also disagreed with electric company witnesses who said vintage-year accounting would involve companies in additional expense. FPC accountants, he said, insist they can show how to set up vintage year accounting without too much expense.

Vintage-year accounting requires maintenance of separate amounts applicable to the plant balances of each vintage year for each class, group, or unit as to which liberalized depreciation methods and service life expectancies have been used.

ATOMIC PROGRESS

Cost Rise . . .

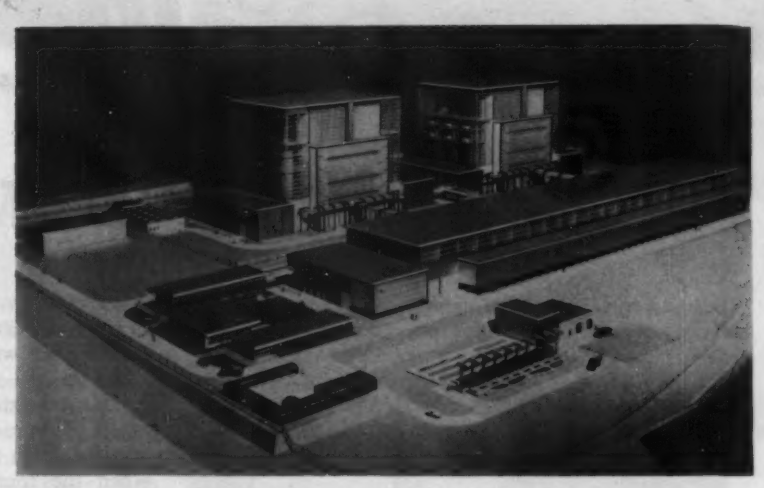
. . . delays two co-op projects; two plans get clearance

A $3-million increase in the ceiling price estimate for the Elk River, Minn., 22-Mw reactor proposal brought an unexpected delay in the project's clearance for Atomic Energy Commission negotiations last fortnight. American Machine & Foundry Co boosted its $5,686,000 estimate just before AEC planned to ask the Joint Committee on Atomic Energy to waive the 45-day review period required before final contract negotiations.

As a result AEC withdrew its request. AM&F said that the increase was necessary to avoid financial loss.

A recent boost from $5.4 million to $14.4 million for the Wolverine Electric Cooperative proposal will also bring negotiation delays, AEC disclosed. Foster Wheeler Corp is the contractor for the project.

Meanwhile, AEC received clearance to begin final negotiations with Consumers Public Power District on a 75-Mw sodium graphite reactor at Columbus, Neb. Clearance was also granted for negotiations with a group of electric utilities led by Northern States Power Co for a 66-Mw boiling water reactor.

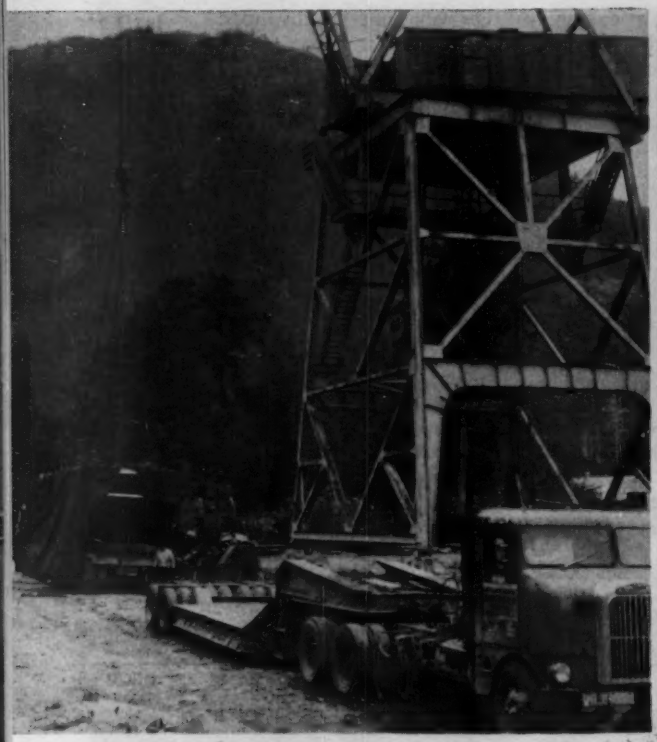


Power Rating Up in Britain's Newest

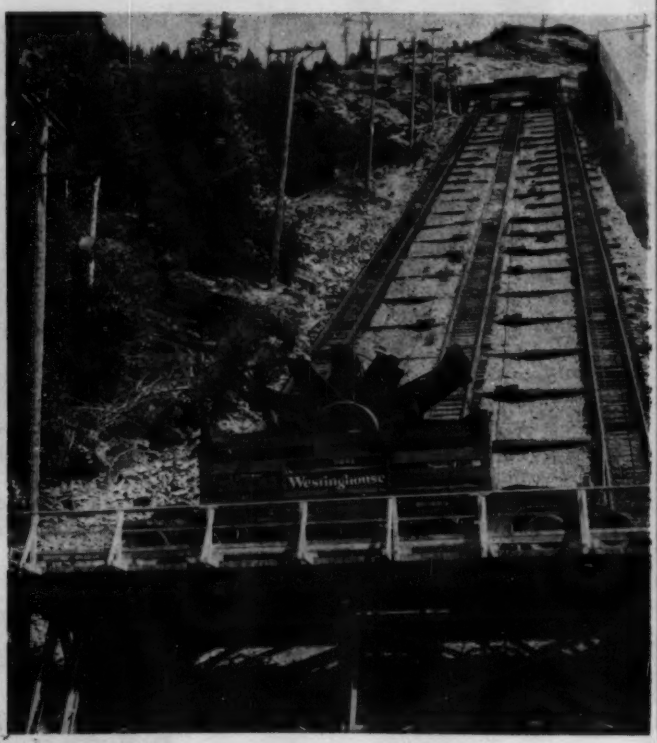
Britain's goal of competitive nuclear power will be nearer reality when its proposed station at Hinkley Point in Somerset, England, goes on the line in 1962. The 500-Mw facility will follow layout and design principles of the graphite moderated reactors at Calder Hall. Although the new plant will use spherical pressure vessels of comparable Calder Hall size, net electrical rating of each reactor is expected to be 55% greater.

The gain is attributed to increases in the major design parameters. A 15% contribution will stem from improved heat transfer characteristics. Extruded multi-start helical fins will be used on fuel element cans instead of machined transverse fins used at Calder Hall. Another 5% will be achieved by a new core loading arrangement. Gas coolant pressure will be up 20% to 175 psi.

The $168-million station will have six main hydrogen cooled turbo alternators of conventional design rated 93.5 Mw at 13.8 kv and 0.85 power factor. Capital cost of the project is estimated at $308 per kw installed compared with about $360 per kw for Calder Hall.



Hauled in two kinds of trailer . . .



Lugged up a steep hill by a rail-hoist . . .

Seattle Installs 980-Ton Generator

Seattle Department of Lighting operates four Westinghouse vertical waterwheel generators in its Ross Powerhouse, 140 rugged miles northeast of Seattle. Installing the fourth one last November involved some unusually tough transportation problems.

This last generator installed at Ross is one of four units rated 100,000-kva, 90% pf, 150-rpm, 13,800-v, 3-phase, 60-cycle. After installation of the first three units in 1954, railroad facilities from Rockport, Wash., to Diablo Dam were removed. Approximately 32 mi of road existed between Rockport and Newhalem. This road was extended from Newhalem to Diablo, using the old railroad right-of-way and bridges through rugged mountain canyons.

SKAGIT RIVER COUNTRY is high in the Cascade Range. Seattle City Light lugged the generator from Rockport to Ross

When the fourth unit was installed the railhead was Rockport. This necessitated unloading material at that point and trucking it to Ross Powerhouse some 37 mi. This one generator consisted of 30 railroad cars of apparatus, weighing 980 tons. The largest single part was ⅓ stator section weighing 105,000 lb. The cast rotor spider was the most difficult part to handle due to bridge clearances and roadway curves.

There were five pieces of equipment, consisting of three stator sections, rotor spider casting and generator shaft, that required double handling due to Washington highway regulations on load limit. A trailer with 32 tires was needed in order to get a state highway permit. This type of trailer was too long and wide to make the curves or clearances on the old railroad bridges between Newhalem and Diablo. It was necessary to unload the heavy parts from the first truck at Newhalem, using a Whirley type crane. These parts were placed on a smaller truck that would operate over the bridges and hauled to Ross. The highway

Floated up Lake Diablo, the generator . . .

Finally reaches the powerhouse

. . . the Hard Way

terminates at Newhalem and the road from Newhalem to Diablo, approximately seven miles, was constructed by the city of Seattle.

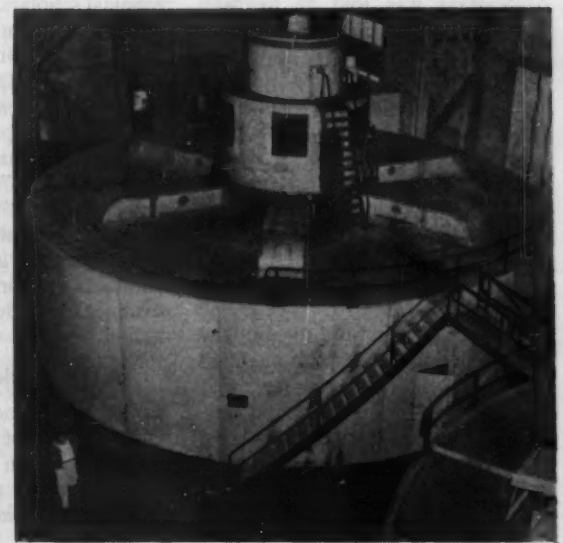
At Rockport, material was unloaded from freight cars onto trucks by use of a stiff-leg crane. At Diablo the trucks were hoisted from the base to top of Diablo by incline, rail hoist. From top of hoist they were trucked to Diablo Lake and placed on barge, then moved by tug to Ross Powerhouse, about five miles by water. At Ross, trucks were moved from barge into powerhouse. Powerhouse bridge cranes were used to unload and install the equipment.

It took six months from start of haulage and installation of this last unit until commercial operation began.

The complete stator was wound on the job site. Installation was handled on a 5-day week schedule, two shifts, 9 hr per shift. Crews lived in a construction camp near the isolated mountain job site.

Perhaps the most difficult part of this installation was the unloading and hauling of the apparatus from the end of the railhead to powerhouse through the mountains. The item of detail supplies required close coordination between the source of supply for the material and the job site to avoid delays.

The performance of this generator has been very satisfactory and its installation helped materially in generation of power throughout the winter peak loads.



And today . . .

Here is the fourth vertical waterwheel generator now in operation at Ross Powerhouse, none the worse for its journey. Rated 100 Mva, 90% pf, 150 rpm, 13,800 v, 3 phase, 60 cycle, the generator has been a welcome addition to the Seattle City Light system.

DON S. KENNEDY (usual order), EEI president; E. M. Naughton, outgoing NELPA president; J. E. Corette, host of anniversary meeting at Glacier Park, Mont., and J. F. Childs, Irving Trust Co vice president, discuss meeting program

Urges Quadrupled PR Effort

Only thus, banker tells NELPA, can utilities win over customers, investors, regulatory bodies to rate rise request

Utility companies must quadruple their public relations' efforts to overcome customers' antipathy to an industry-wide rate increase, the Northwest Electric Light & Power Association was told at its 50th anniversary meeting recently at Glacier Park, Mont.

The utilities are being prodded into such a rate-increase request by the continuing inflation, declared John F. Childs, vice president of New York's Irving Trust Co. He added that present technologies do not permit operating savings to accrue as they did in the past.

Would Enlist Employees

Hence, he said, utility-company public relations must be brought to bear, first, on the customers, and through them on investors and ultimately on the regulatory bodies. The utilities, he suggested, could begin by enlisting employees as their ambassadors.

In recruiting technical manpower, the utilities should start early in impressing college students with the opportunities in the business, said Don S. Kennedy, Edison Electrical Institute president. Such salesmanship, he added, must be continuous.

Kennedy urged utilities to maintain a good work climate and to seek ways of divesting engineers and middle management personnel of routine so as to free these groups for creative work. He also urged utility people to take an interest in school problems at all levels. He also advocated establishment of technical scholarships for employees' children and employment of engineering instructors in summer work.

NELPA's outgoing president, E. M. Naughton, denounced a proposed revision of the Internal Revenue Code. The revision, he said, is "discriminatory;" it would prohibit deductions for "political" purpose funds, yet exempt non-taxpaying public power groups who have admitted spending 5% of annual revenue for "education and information."

Hits Appropriations

Naughton also denounced a proposal to restrict lobbying further. The proposal in its present form, he said, would prohibit conversation with or writing to a federal lawmaker without registering as a lobbyist.

Congress was too headlong in appropriating funds for four public-power nuclear stations, George M. Gadsby, board president of Utah Power & Light Co, told the NELPA. This is not the time, he said, for spending money for untried plants.

Engineering of the plants has been authorized against the advice of the experienced Atomic Energy Commission staff, said Gadsby. The best current technical opinion, he went on, expects no competitive nuclear power until the second generation of stations, completed in 1965-67, has passed on its results to the third generation.

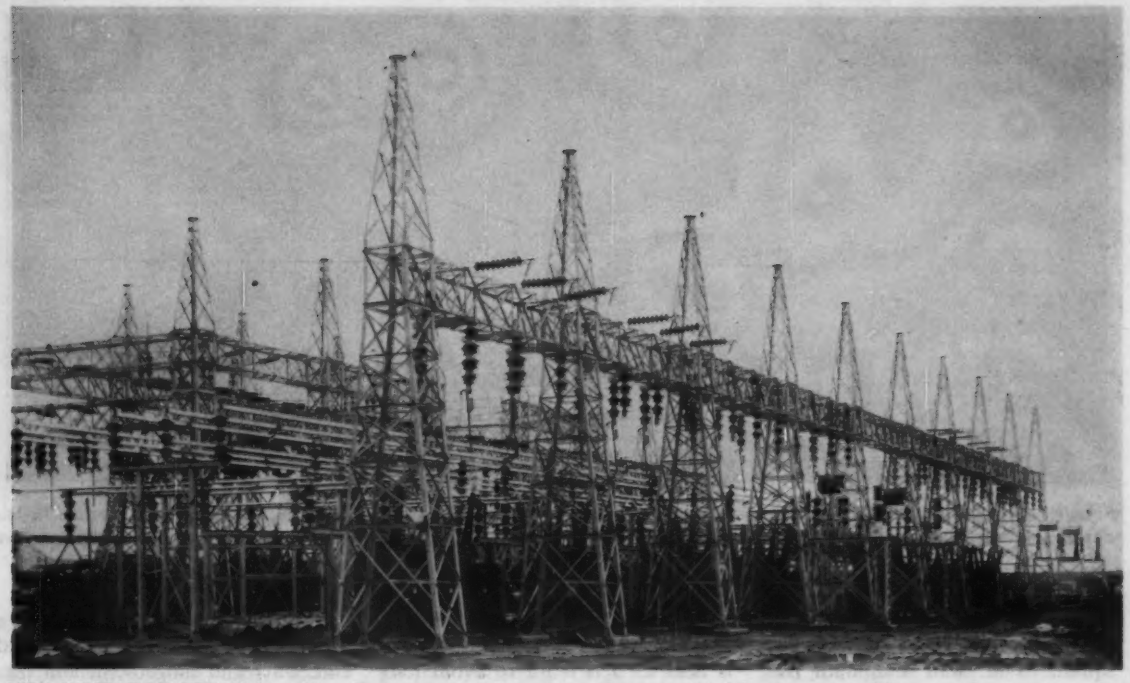
Meanwhile the investor-owned industry, he said, is proceeding at the proper speed of development of the many reactor types.

Electrical equipment manufacturers today are spending 6% of their sales income on research and development, a sum representing 20% of the total funds for research and development spent in this country, reported M. B. Wyman, Westinghouse Electric Corp. These expenditures, he said, are to keep up with utility load growth.

NELPA Elects

Utilities must be ready for rapid change in customer utilization, said E. R. Sample, Southern California Edison Co. Minimum scrapping can be attained, he said, by keeping an open mind in planning new equipment, which should be designed with the utmost flexibility. For this, he added, the investment increment is relatively small.

NELPA officers elected for 1957-58 are: John T. Kimball, Idaho Power Co, president; Thomas Ingledow, British Columbia Electric Co, first vice president; and George M. Brunzell, Washington Water Power Co, second vice president.



NEW SUBSTATION DESIGN based on direct bus-mounting of selector switches cuts structural steel tonnage by about 60%, reduces required bus supports, fittings, and connectors, simplifies erection, and provides better spacing of equipment

Selector Switches Bus Mounted

New design for 115-kv substation reduces overall costs, affords equipment spacing without loss of reliability

J. Q. WRAY, JR, Assistant to Chief engineer, Duke Power Co, Charlotte, N. C.

New design reduced overall costs for Duke Power Co's 115-kv substation at Allen Plant without sacrificing reliability. The plant's first 165-Mw unit is now in operation. Major innovation is direct mounting of modified selector switches on the buses and their structures. This arrangement, believed to be the first of its type in this country, reduces selector switch costs by 60% and permits changes that:

1. Reduce required bus supports, fittings, and connectors.
2. Cut steel tonnage by about 60%.
3. Simplify erection.
4. Provide better spacing between equipment.

The new design was based on an analysis of past practices. For the analysis it was decided that it is better to attempt improvement of a substation arrangement familiar to personnel rather than adopt an entirely new one. Past practice on the Duke Power 100-kv system called for use of the double-bus, selector-switch scheme. Although this scheme is very adaptable to a two-level bus arrangement, it requires considerable steelwork, which makes it difficult to trace circuits and operate hook-stick disconnect switches.

Adapted from a paper presented at the Southeastern Electric Exchange, Engineering & Operation Section Conference, Miami Beach, Fla., May 2-3.

Reconsider Design

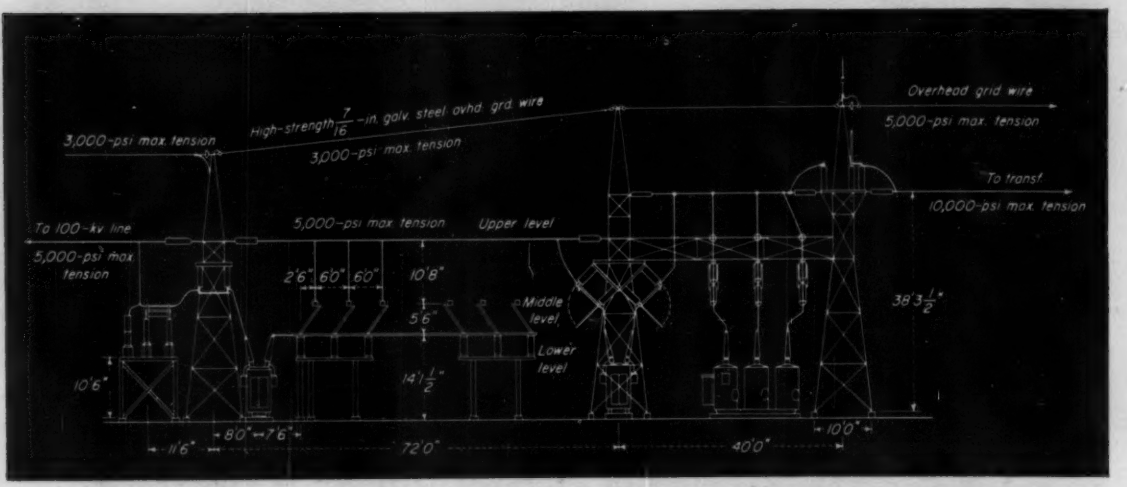
Steelwork consisted of a 2x2-ft box column and girder combination constructed in an "erector-set" fashion (EW, July 30, 1956, p 16). Maximum dimension between column center lines for the 2x2-ft girder was 22 ft. The 20-ft length of breakers made it difficult to obtain sufficient spacing for fire clearance. Hence rigid bus construction usually was required. With these limitations in mind, Duke Power designers took a "new look" at the design for the substation at Allen power plant.

The substation arrangement serving both generators at Allen Plant maintains the double-bus, selector-switch scheme and has one oil circuit breaker per circuit. The scheme was complicated through the necessity of isolating No. 2 generator on a 185-Mva autotransformer to supply the 230-kv system.

Sized for 320 Mva

Each of two 192-Mva, 18-kv generators is connected through a 185-Mva transformer to 115-kv buses. Transformers are adjacent to the power plant wall, about 300 ft from the 115-kv substation. The 18-Mva, 110-4.16-kv starting transformer, situated between the unit transformers, is sized for future 320-Mva generators. The new substation combines a strain-bus and rigid-bus design, and rearrangement of bus-selector switches simplifies the design.

The hinged end of each selector switch is supported on the lower 3½-in. IPS aluminum cross-bus insulator support, which also supports one end of the 29-ft bus span. The



STRAIN AND RIGID BUSES are used to advantage in the design. Strain bus and spans to main transformers are 1,113-MCM ACSR; rigid main bus consists of 5-in.-sq, ¼-in.-wall aluminum conductor on insulators on 30-ft centers

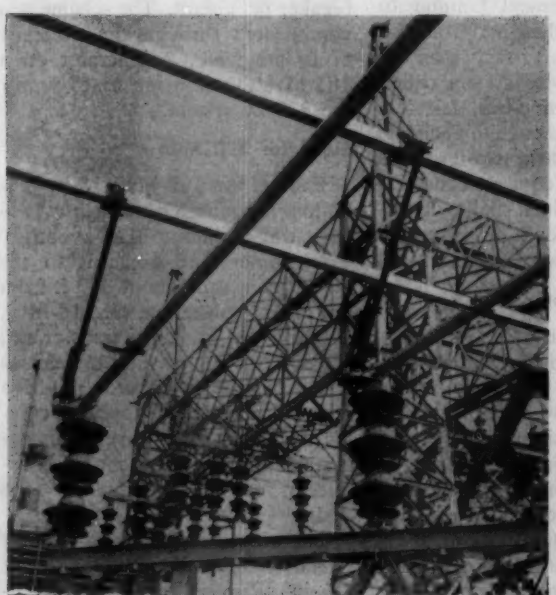
jaw or contact end of the switch is secured to the main 5-in. hollow square ¼-in. wall aluminum bus, which is supported on insulators on 30-ft centers. Jaw contact for the middle phase is in the center of the 30-ft span. Two outside phases are about 9 ft from the insulator supports. All insulators are mounted on 3½-in. high adjustable insulator bases to allow accurate alignment of buses.

Clearance from ground to the cross bus is about 15 ft; spacing between cross bus and upper main bus is held to 5 ft 6 in. to avoid long switch blades. Adequate aisle space between two main buses permits safe use of a hook-stick for operating selector switches. To facilitate operation of switches and simplify phase location, cross-bus supporting steel is at an angle to the main bus.

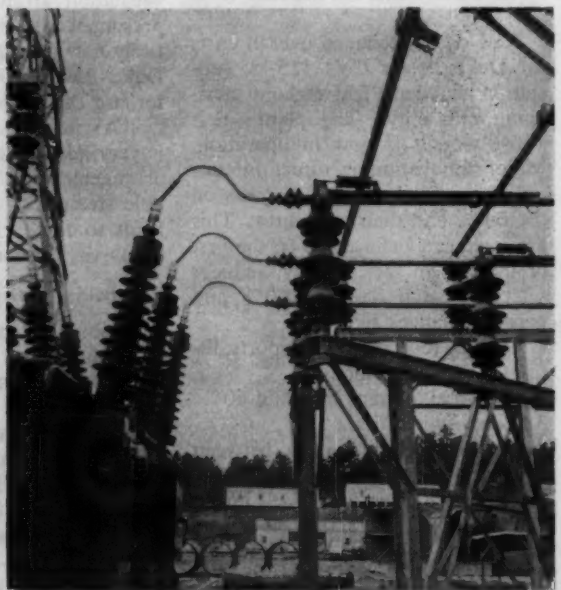
Switches rated 1,200 amp are an adaptation of a standard hook-stick-operated disconnect. The switch has high-pressure contact jaws and a braidless connection at the hinged end. Jaw and hinged-end adapters are cast aluminum alloy; jaw and hinged contacts are of the same standard copper alloys used in high-pressure contact switches. The blade is copper.

Each Blade Has Buffer

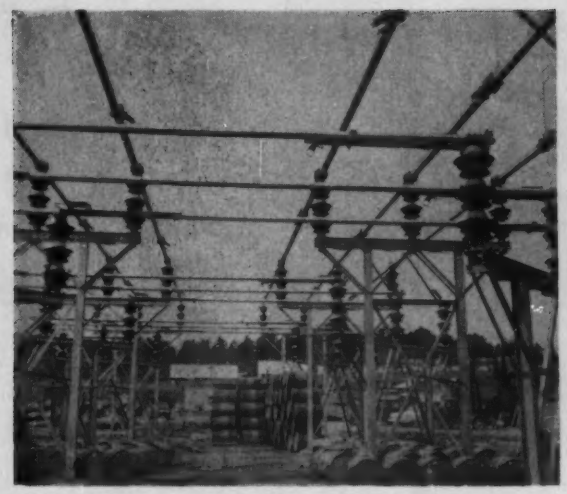
For easier switch operation, the blade is at a 32-deg angle from the vertical when closed. To prevent



CLOSED SWITCHES are at an angle for ease of operation. Blade stop on the cross bus holds blade in the open position



HINGED END of selector switch mounts on lower cross-bus insulator support. Contact jaws attach to upper main bus



AISLE SPACE is provided between main buses. Supporting steel for cross buses is at angle to facilitate operation

PLASTIC CONDUIT in 30-ft lengths forms banks for control and auxiliary power. It is less costly, easier to install

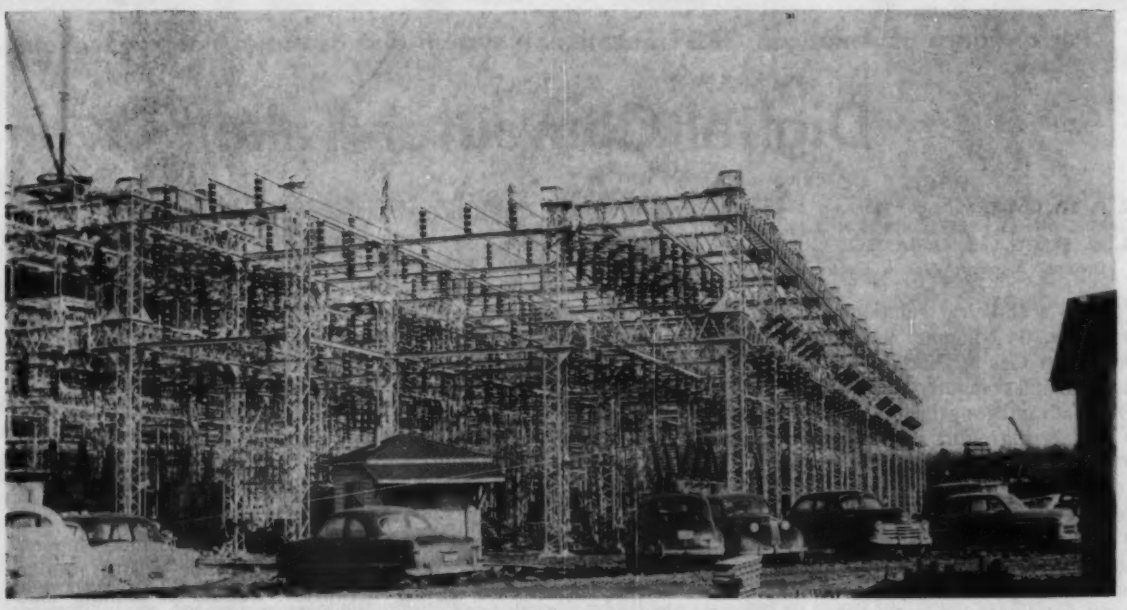
damage to the switch, should it get off the hook-stick during opening and closing, a buffer is included on each blade. A stop on each cross bus for the blades serves also as a rest for the blade in the open position.

Expansion, contraction, and deflection of buses required special attention because of their effect on alignment of the switches. Expansion and contraction of the cross bus were calculated at 0.32 in. in a 29-ft span for a ± 70F variation. To allow for this movement, a combination hinged-end and bus-support adapter permits the bus to slide at the switch on one end of the bus. The other end is fixed. At the slide supports, a braid from the bus to the hinged-end adapter shunts the current around the slide support. Deflection on the cross bus was no problem because the hinged support of the switch is at the bus support.

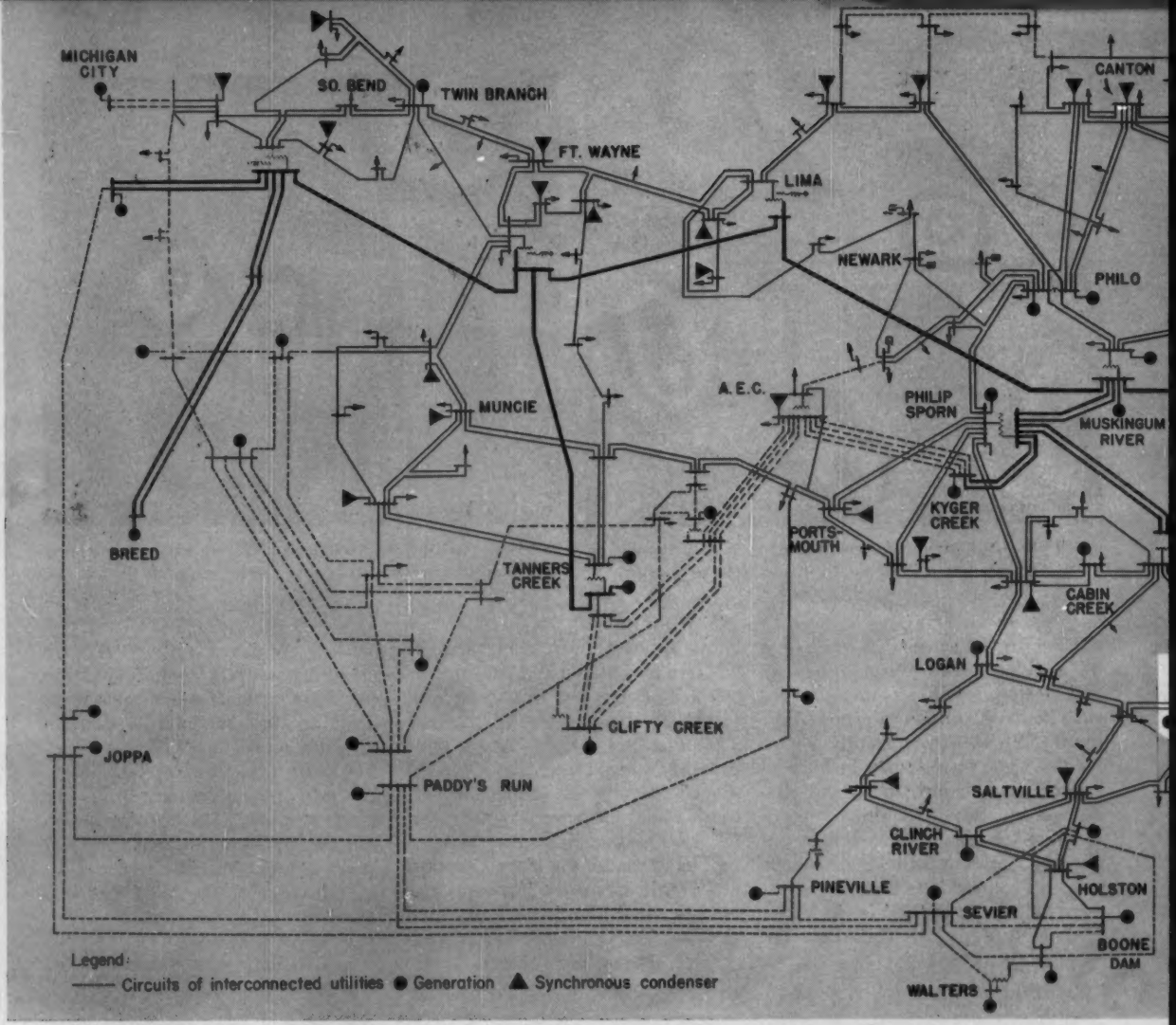
Upper main buses were designed to allow for both deflection and expansion. An expansion joint at every other bus support limits expansion to a 30-ft span. If the installation is made at 70F, maximum expansion or contraction in the 30-ft bus would be 0.33 in., or 0.22 in. to the jaw contact farthest from the fixed support. The switch design will permit a tolerance of ± 0.375 in. in a horizontal direction.

Deflection of the main bus was

(*Continued on page* 108)



OLD DESIGN PRACTICE for double-bus, selector-switch scheme in 100-kv substations required considerable steelwork. This construction was costly and interfered with visual tracing of circuits as well as with hook-stick operation



Performance of American G&E transmission system and its major interconnections

Digital Computer Takes Over

H. P. ST. CLAIR, Manager Planning & Operating Engineering,

G. W. STAGG and **MARIA TSCHERNE**, Planning & Operating Division, American Gas & Electric Service Corp, New York

Fast, economical solutions for load flow problems with the 704 computer have proved so successful that American Gas & Electric Service Corp now plans to use a digital computer for all future major load studies. Other advantages gained by this decision are:

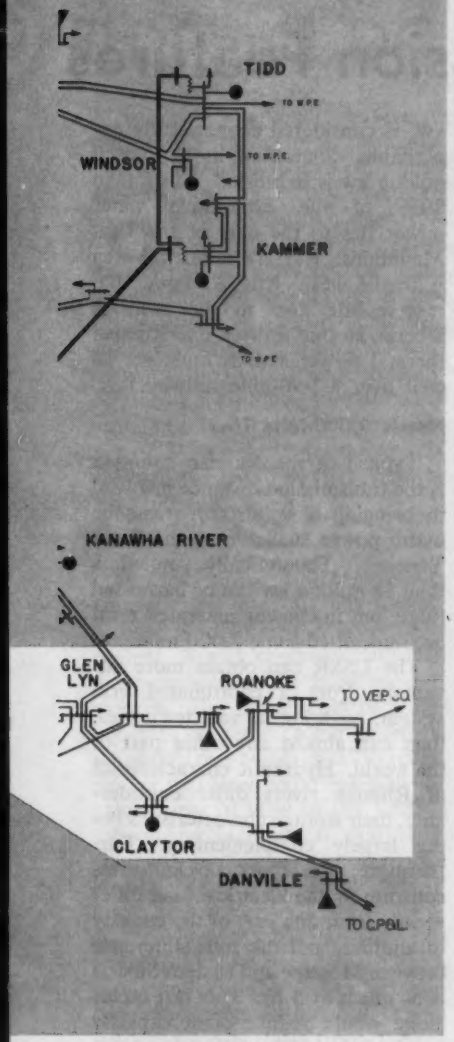
- Engineering effort will be substantially reduced.
- Studies can be interrupted for analysis and revision at any time, thus gaining new flexibility without incurring a cost penalty.
- Additional cases can be studied at any time without set-up delay by feeding system changes into the computer with punched cards.
- All voltages, angles, load flows, and other data are fully and automatically tabulated for further study.

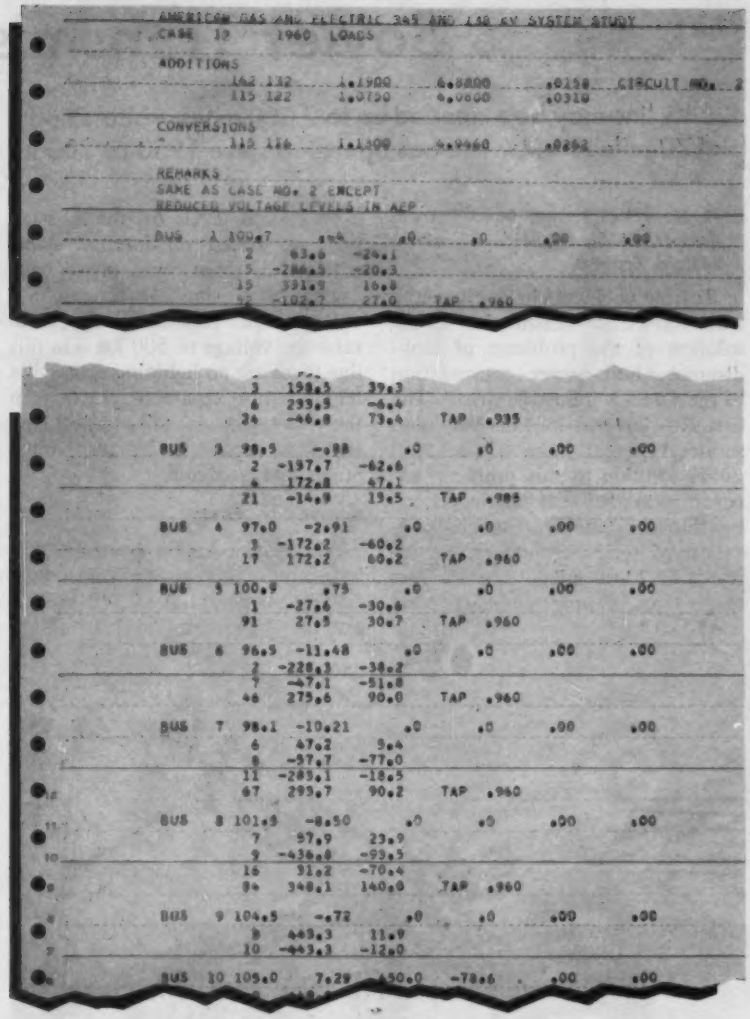
The digital computer approach has been tested by using it to calculate load flows for the entire AG&E system, including the actual lines or equivalents of major interconnections. The computer calculated 13 different cases, by groups of 3 to 4, in 1.75 hr, proceeding automatically from case to case. Actual calculations ran from 3.5 to 8 min per case.

A comparable analysis would have required 7 days or more on the largest available network analyzer. Charges for use of such an analyzer would have been at least $2,800 (at $400 per day) compared with $1,300 for use of the digital computer and associated equipment.

The program was designed to utilize the computer as much as possible in minimizing the tedious, routine work of solving networks. Besides calculating load flows, the computer did the following:

1. Made system changes, such as line and trans-





or local subtransmission . . . is tabulated automatically for analysis

Load Flow Calculations

former outages, additions, conversions, etc., as well as generation and load changes.

2. Recorded all system changes, case numbers, and load periods.

3. Progressed automatically from case to case without manual intervention.

4. Calculated automatically the loadings for synchronous condensers required to maintain voltage levels, recognizing limitations of machine ratings.

5. Prepared system impedance data in suitable form to feed into the computer.

The computer program and data describing the system were fed into the machine from high-speed magnetic tape. System changes for each succeeding case were read in automatically from punched cards for as many cases as desired. The results were recorded on magnetic tape for subsequent automatic tabulation.

The versatility of the program is such that it can be applied economically to smaller subtransmission networks. Typical of such applications is the recent load study of Appalachian Electric Power Co's Roanoke Division (unshaded area above plus local 33-kv circuits). For this system, the computer solved 11 cases in 7 min at a cost of $99 which included standard rental charges for associated equipment. Data for all changes from case to case were prepared in advance and fed into the computer at the start. The same study would have taken two days on a network analyzer.

The entire new program was assembled and tested, and both series of load flow calculations carried out by the AG&E Service Corp staff, making use of the 704 computer at IBM's Service Bureau Corp in New York. Experience wth the new program, though most gratifying, has indicated areas of possible improvement which are expected to bring additional savings in computer time and cost.

Soviet Transmission Features

400-Kv line may be extended up to 2,000 miles, visitors hear; trial 70-mile, 30-Mw line has operated since 1950 at 200 kv

J. H. M. SYKES, Editor, Direct Current; Member, CIGRE DC Study Committee, Bedford, England

Russian engineers have pioneered with 400-kv ac transmission as the solution of the problems of long-distance, bulk-power transmission to the USSR's industrial areas. The first Russian 400-kv line went into service last year. The 400 or 500-kv ac solution to this problem, according to Russian engineers, is capable of extension, through application of series capacitors, to upwards of 2,000 miles. For the past seven years, Swedish engineers have used 380 kv.

Insulation levels for the Russian line are based on internal overvoltages of three times phase voltage, and by using 2½ times phase voltage the Russians expect to raise the voltage to 500 kv. On this line there are no lightning protection features not common practice in the West, for in this respect the Russians appear to lag the United States and England.

Sources in East

The Soviet Union possesses unharnessed water power with a total theoretical potential of 340 million kw, of which 50%, or 170 million kw, is considered economically exploitable. Somewhat more than 6 million kw is harnessed. More than 80% of the exploitable water power lies to the east of the Ural Mountains. Russia's industrial area is to the west. Russia's large coal reserves lie also to the east, in Siberia, so that at least one Russian thermal power station must get its coal over a 950-mile railway link.

Needs 2,000-Mile Line

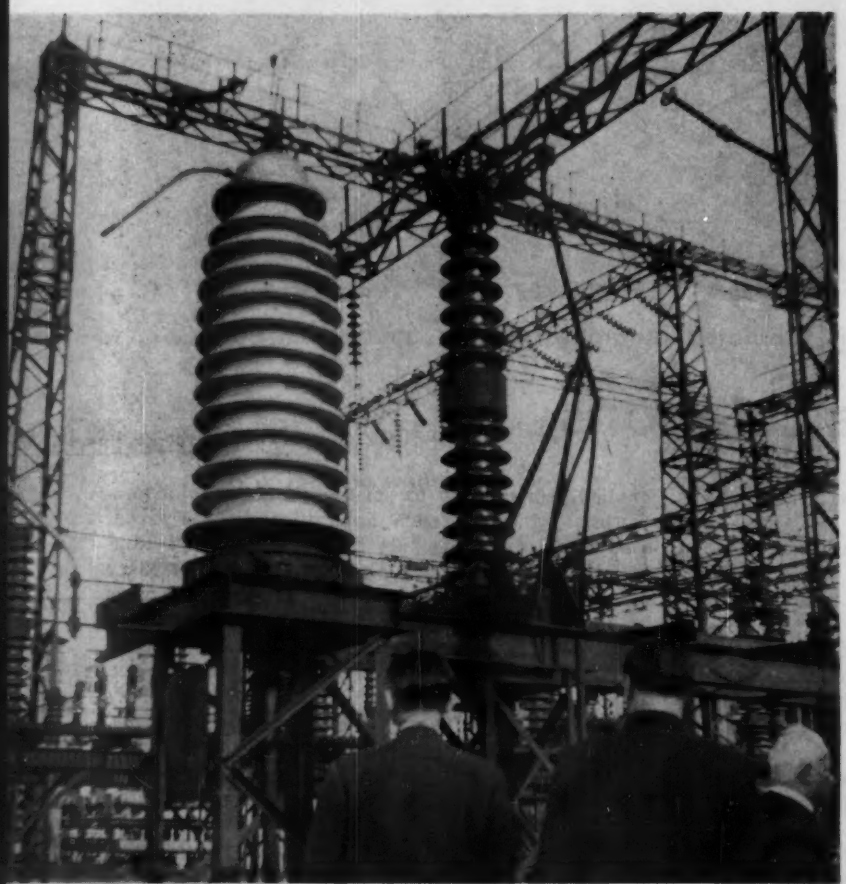
Typical of the Russian situation is the transmission distance involved in bringing to industrial areas the hydro power available on the River Yenesei. Theoretically, no less than 18 million kw can be harnessed there, but the power generated must be transmitted some 2,000 miles.

The USSR can obtain more advantage from a coordinated grid system, covering its vast territories, than can almost any other part of the world. Hydraulic characteristics of Russian rivers differ considerably, their storage characteristics being largely complementary. Furthermore, the types of industries constituting the electrical load differ greatly from one part of the country to another, and the time difference between Moscow and eastern Siberia is as much as 5 hr. This last factor alone would reduce plant capacity required for 100 million kw maximum load by as much as 4%.

Station Ready in 1958

On his recent visit to the USSR, the author saw the Moscow substation (at Noginsk) of the new 505-mile ac transmission line from Kuibishev, whose hydroelectric station has an ultimate capacity of 2,100 Mw. This station will be completed in the next year.

The Moscow-Kuibishev 400-kv link consists of two single circuits, mounted on separate portal-type towers about 100 yd apart. Towers are about 95-ft high and 100-ft wide. Of the three intermediate substations, one in the center of the line will ultimately contain series capacitors. The others are simply sectionalizing points with circuit breakers to facilitate operation. With both circuits operating, the line will transmit 1,150 Mw.



CABLE TERMINAL (white insulator) for the 200-kv direct-current transmission scheme which connects Moscow to Kashira was inspected by visiting engineers

EHV and DC

Steel-core aluminum phase conductors are strung in a triangular bundle, three conductors per phase, spaced 15¾ in. They have 19 strands of 0.0786-in. dia steel, surrounded by 54 strands of 0.1325-in. dia aluminum. Compression joints and clamps and Stockbridge dampers are used. A releasing clamp on the suspension sets allows the conductor to slip through under broken-conductor conditions. Insulators are tested to a 50-cps wet flashover voltage of 775 kv (rms); full-wave 1.5x 40-microsec test voltage is equal to 1,800 kv (peak).

Towers Not Galvanized

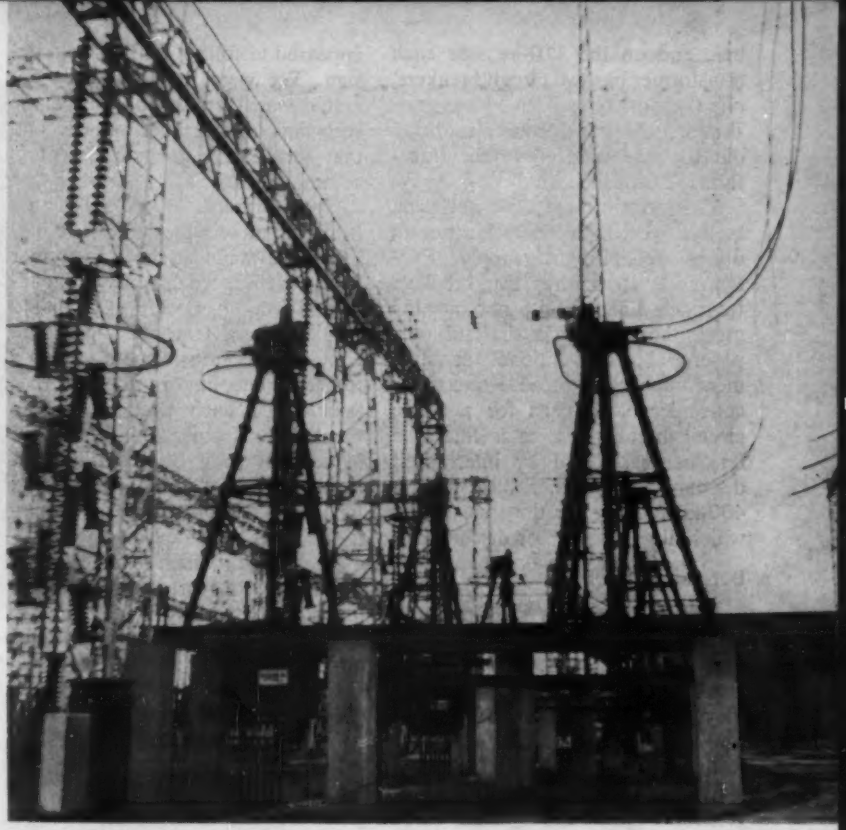
Welded lattice tower members are not galvanized, but only roughly painted, so that rust is everywhere evident. Soviet engineers said that they appreciated the need for galvanizing. But the urgency of bringing the line into commission on schedule, they said, was so compelling that they could not wait for galvanizing, in view of the USSR's galvanizing facilities at that time. Gangs of middle-aged women are already painting the lower parts of tower structures.

The Noginsk substation has 220 and 110-kv switchgear in the same compound with the 400-kv termination. Substation layout has only a few strange departures from conventional lines; disconnects and switchgear are not fenced off. There is nothing to deter a man from climbing the wrong disconnect during maintenance work.

Most radical departure from Western practice is in the electrical layout of the 400-kv section of the substation, which forms the terminal of one of the two 400-kv single circuits. The other terminates at a substation 20 miles away. A 400-kv tie line is being built between these stations. Only one 400-kv line at Noginsk is in commercial operation.

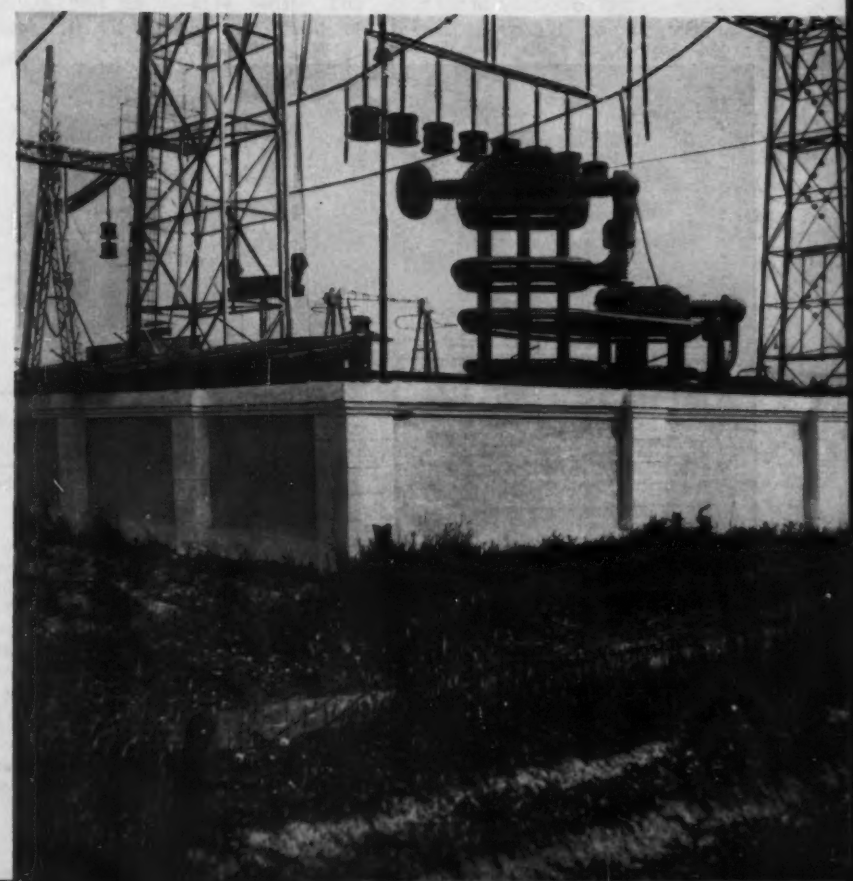
Lacks Flexibility

Each line has two air-blast circuit breakers, each with a disconnect on either side. Circuit breakers are tied in permanently, one to each of two 400-kv buses. Two 270-Mva, 400-110-kv transformer banks are connected solidly, one to each



DISCONNECT SWITCH for the 400-kv ac line from Noginsk (Moscow) has a 16.5-ft blade. Its ability to interrupt transformer magnetizing current is not known

CASCADE TRANSFORMER which develops a 50-cps, 2,500-kv potential is one of many research facilities at the USSR'S Leningrad EHV testing station



bus, and on the 110-kv side each transformer has two circuit breakers, one tied solidly to each 110-kv bus. Tripping of a transformer must bring out the line selected to the transformer's own bus.

This arrangement does not seem to lead to flexible operation nor to utmost reliability of supply. Furthermore, it requires two breakers for each line circuit, one at any given time serving no useful purpose. The conventional arrangement appears to provide maximum convenience. It calls for a single circuit breaker on each line, the line being selected by interlocked disconnects to either bus, with a 400-kv breaker for the transformer which also has selector disconnects.

Defend Risk

Russian engineers said that the two additional disconnects would cost more, and that, in their view, transformer faults were so rare that they felt justified in risking an arrangement without a 400-kv transformer breaker.

Westerners were surprised at the general rough-and-ready state of the plant, where, nevertheless, everything appeared to work. The 400-kv breakers, with seven elements in the air-blast arrangement and a 10,000-kva interrupting capacity, appeared to follow conventional design. We were told that they operated satisfactorily on automatic reclosing, single and 3-phase, and that this operating arrangement is common in Russia.

Transformers at Noginsk are probably among the largest. Windings were made at the transformer factory at Zaporozhie, and the concentric windings were brought to Noginsk in a temporary gas-filled container. Transformers employ forced-air cooling in the form of fans inside each nest of cooling tubes. Transformer tanks were built in sections in a brick building at Noginsk and welded together round the cores and windings. Transformers are mounted on an ingenious carriage, which enables each unit to be transported directly from its point of assembly in the building, along a railway track, and (at right angles) to its final site.

Stick to Essentials

The rough construction of this brick building perhaps typifies the Russian approach to what is regarded as non-essential.

Access roads in the substation are earth tracks which are deep in mud when it rains. The Russian view is that nicely made-up tracks contribute nothing to the plant's purpose. A Russian senior engineer, who had visited the neat substations on the British 275-kv system, said that Soviet authorities are aware of the need for further attention to finish.

"Should you care to come back to Noginsk in two or three years," he said, "you will be surprised by the difference."

The 400-kv disconnects are motor driven and have a 16-ft, 6-in. blade. Experiments, we were told, had been carried out to test the interruption of a transformer's magnetizing current, so far without any conclusion being reached.

Discuss 400-Kv Troubles

The Russians were frank about troubles experienced during the first 15 months of operation of the first 400-kv section. There were five outages, all single-phase faults. Two were due to galloping conductors, a sudden release of ice causing a phase conductor to touch the ground wire. Two faults were caused by tree branches blown during a hurricane across the 33 ft separating phase and ground wires. A Russian "cowboy" with his lassoo caused another.

Although television is widespread, particularly in the Moscow area, there were no reports of television or telecommunication interference from the 400-kv line. The conductor arrangement largely explains this.

Plan Boost to 500 Kv

The Russians intend to raise the 400-kv system to 500 kv. Experimental work at the Leningrad high-voltage laboratory has shown that 2½ times phase voltage is a more realistic figure for the probable internal overvoltage than three times phase voltage. Using the new figure, the Russians expect to convert a large proportion of the 400-kv equipment to 500 kv. Transformers could be adapted as 500-kv equipment by joining the 110-kv winding to the 400-kv winding in an autotransformer arrangement. Air-blast circuit breakers, with seven interrupting elements, could be altered to take an eighth element.

The 400-kv (or 500-kv) ac solution to long-distance, bulk-power energy transport appears to Russian engineers to be capable of extension, through the application of series ca-

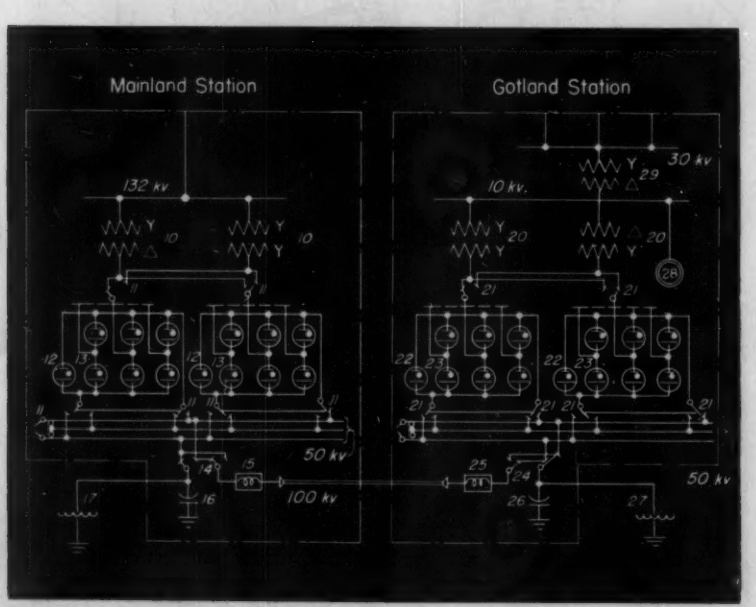


FIG 1—SWEDISH DC TRANSMISSION typifies their approach in the use of one rectifier per bridge arm. Research in Sweden is directed to evolving rectifiers to withstand greater inverse voltages and to carry higher currents

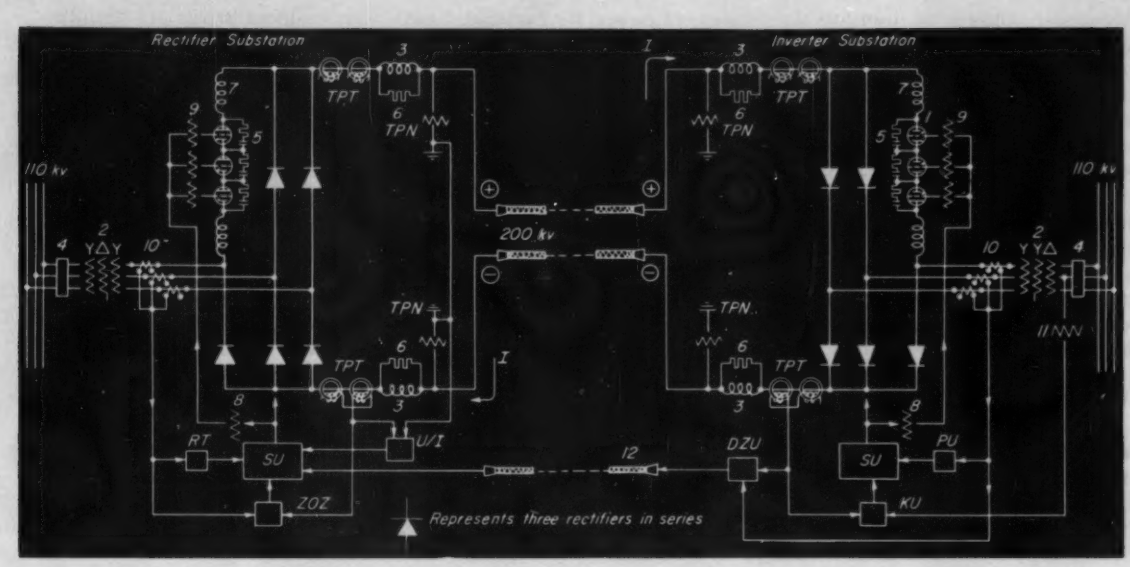


FIG 2—RUSSIAN DC SYSTEM under test since 1950 reveals their initial reliance on several rectifiers in series per bridge arm. Although feeling this scheme is superior, they are testing a scheme utilizing one rectifier per bridge arm

pacitors at intervals along the line, to distances up to 2,000 miles. This is not necessarily the best economic solution, as has been realized more strongly in Russia than anywhere except Sweden. Accordingly, a high-voltage dc transmission research program has been under way in the USSR for more than 12 years.

In the author's opinion, discussions at two CIGRE DC Study Committee meetings at Leningrad showed that USSR engineers are abreast but not ahead of research into high-voltage dc transmission problems in Sweden. Although satisfied with the long-term tests on the 200-kv Kashira-Moscow trial dc transmission scheme, the Russians were not yet satisfied that they had solved all rectifier problems for the much larger 800-kv Stalingrad-Donbass scheme. It seemed improbable that the scheme would go into service by 1960, as planned. But it is difficult to apply conventional criteria to an industry so completely planned and coordinated as the USSR electrical industry.

The Russians report no progress in circuit breaker design for dc systems, a fact which may not be as important as it may seem. The Swedish view is that dc circuit interruption can be done by blocking all rectifier grids briefly (milliseconds) while a fast-opening disconnect isolates the circuit.

Russian effort in dc transmission has been on a scale similar to that in Sweden, except that no essentially commercial line has yet been energized. A 70-mile, 200-kv, 30-Mw dc scheme, coupling Kashira to Moscow, has operated on an experimental basis since 1950. Russian engineers are convinced that the dc solution has economic and technical advantages essential for future transmission. They estimate that the cost of transmitting 1 kwhr becomes equivalent for ac and dc somewhere between 520 and 620 miles. For a longer distance, the dc solution is more economic, whatever the ac voltage or layout. Annual losses, they said, equalize for ac and dc for a line about 434 miles long.

NOTES FOR FIG 1—10,20—Main transformers; 11,21—Five-pole, double-throw disconnect switches; 12,22—Bypass rectifiers; 13,23—Main rectifiers; 15,25—Smoothing and damping circuits; 16,26—Overvoltage protective capacitors for line to electrode station; 17,27—Electrodes; 28—Synchronous condenser; 29—Step-up unit

NOTES FOR FIG 2—1—Pool-type-cathode power rectifiers; 2—Main transformers; 3—Line reactors; 4—Main circuit breakers; 5—Voltage divider; 6—Damping resistor to suppress acoustic-frequency oscillations; 7—Reactor for suppression of hf oscillations upon rectifier ignition; 8—Rectifier groups insulating transformers; 9—Individual rectifier insulating transformers; 10—Current transformers; 11—Potential transformers; 12—Pilot cable; SU—Grid control; RT—Current regulator; KU—Compounding unit; TPT—Dc transformer; TPN—Continuous-voltage transformer; ZOZ—Arc-back protection; U/I—Short-circuit protection in dc line; PU—Pickup unit; DZI—Differential protection of inverter

1,000-Kv Dc Line Planned

The Moscow-Kashira scheme is intended as the forerunner for a 340-mile, 800-kv scheme connecting the Stalingrad hydro plant with the Donbass region. It will operate at 800 kv (±400 kv to ground) with a 750-Mw capacity. This line, planned for 1960, is meant to provide operating experience for a much longer line at 1,000 kv, tying the remote hydro resources of Siberia and elsewhere to the industrial areas. The line will be overhead, employing twin conductors for each pole. The Moscow-Kashira project includes some dc underground cable to provide experience in cable design and operation.

The Direct Current Institute in Leningrad is the center of the Russian effort in both dc and EHV ac transmission. It employs 604 people, of whom 230 are engineers and physicists, and has charge of the

Moscow-Kashira trial transmission employing 70 engineers.

There are several branches of the institute's work, these being dc regimes in general, covering dc system operation, rectifier research, protection and control, and the high-voltage test and development laboratory for ac as well as dc equipment. Also included are the electrical systems laboratory, including system simulators of many kinds, the measurement laboratory, including work on insulation and fault location, and the construction department for making prototypes.

Laboratories include network analyzers and model systems of many kinds. For the Stalingrad-Donbass scheme, there is a model high-voltage dc setup of 2.5-kv 5-amp capacity. A large machine hall contains "micro-reseau" machines, simulating the performance of thermal and hydro generators.

Several members of the CIGRE committee said that the "miniature-network" machines of about 100-kva size seemed unnecessarily large and cumbersome. But the arrangements whereby their electrical and mechanical characteristics can be changed, by such devices as changing damping windings with rapidly replaceable sections, were thought to be excellent. Measuring instruments, oscilloscopes, and similar gear appeared to be somewhat behind Western standards, but lavish in quantity.

Research Volume High

Investigations at the institute into system operation and planning of interconnected systems were on the same lines as those in other countries. It is perhaps just to say that Russian engineers are a fraction behind in original thinking but somewhat ahead of Western developments in research volume.

In the dc field, Russian experimental work is on a greater scale than in any other country. Nevertheless, the very long-term research of the Swedish engineers has produced neater and more economical solutions to most dc problems.

The basic problem in dc transmission is the design of the mercury-arc rectifier and control gear. Practically all other equipment is basically similar to that used on ac transmission. When considering the use of dc transmission for large blocks of power, for example, 1,000 Mw, there is an obvious need to employ voltages of the order of 1,000 kv. The first consideration is to determine how many rectifiers will have to be used in series in each converter bridge.

The bridge connection in the Swedish Gotland scheme is shown in Fig 1. Two 50-kv, 200-amp mercury-arc rectifiers in series provide 100 kv. Only one rectifier per bridge arm is used. In the arrangement for the 200-kv Moscow-Kashira system, earlier experiments were carried out with three rectifiers in series in each arm of a single bridge. The bridge provided arrangements for operating either at 100 kv, or with one pole grounded and the other at 200 kv to ground. This is shown in Fig 2.

Use Bypass Rectifier

With three rectifiers in series in each bridge arm, Russian engineers hoped to ensure that under no possible circumstance could a flashover or other temporary interruption cause a system shutdown. Both the Swedish and Russian schemes employ a bypass rectifier (or rectifiers) to carry the current momentarily during any transient fault, such as an arc-back. During the author's visit to the Moscow-Kashira scheme, there was much discussion among Swedish and Russian experts on the desirability of attempting to use only a single rectifier in a bridge arm.

The Russian view was, in general, that by "under-rating" the rectifiers with respect to inverse voltage, the possibility of complete absence of internal rectifier troubles would be greatly enhanced. Thus by using two, three, or more rectifiers in series in each bridge arm, they hoped to achieve a standard of reliability equivalent to that of a normal ac scheme.

What Swedes Hold

On the other hand, use of rectifiers in series in a bridge arm causes overall cost of convertor equipment for a given voltage to rise steeply. The Swedish view has always been that research and development work should be directed towards evolving rectifiers to withstand greater inverse voltages, and with high current ratings, so that single rectifiers could be used in any required bridge arrangement.

During the visit to the Kashira scheme, USSR experts seemed to be coming round to Swedish thinking. Trial transmission had been rebuilt recently so that two separate bridge arrangements could be tried out. In one, two rectifiers in series were used on each bridge arm, and in the other a single rectifier. Latest rectifier designs were observed under test. A rectifier, provisionally designed for 120-kv peak inverse voltage, was found to operate satisfactorily in practice at 80 kv.

Prefer Bridges in Series

Russian engineers said they could not prove that the arrangement with three rectifiers in series was definitely superior in regard to absence of trouble through arc-backs to the single rectifier arrangement. They felt a bridge using a single 60-kv rectifier in each arm, with a number of such bridges in series, would be desirable.

For the Stalingrad-Donbass link, the scheme proposed is to use, in each convertor station, eight identical bridges for 100 kv, and containing two rectifiers per bridge arm. To quote the Russian report to the CIGRE DC Study Committee, "The recommendation to use two rectifiers in series in each arm of the 100-kv bridges is based on the desire to provide better operating condition for the rectifiers during the first period of operation. On gaining sufficient operating experience, it will be possible to change to bridge circuits with one rectifier in each bridge arm."

Tests Rectifiers

At the DC Institute, ten rectifiers were under long-term test, some operating at 150 kv with 200 amp per anode. A particularly interesting feature was the testing of rectifiers without potential grading electrodes, or grids, down the length of the anode chamber. It has generally been thought essential for arc-control purposes that these grids, with an associated external potential dividing network, be provided. The Russian grid-less rectifiers (of the above type operating at 150 kv, 200 amp) were found to work satisfactorily at 120 kv, 150 amp, for several months. Another test group of rectifiers was operating at 200 kv, 1,200 amp.

This bottom leads a sheltered life

A capacitor bottom needs protection these days. The now-standard 50-kvar unit is too heavy for any man to lift safely. We found this out when we introduced 50-kvar capacitors in 1955. They got dragged and pushed and the bottoms took a beating.

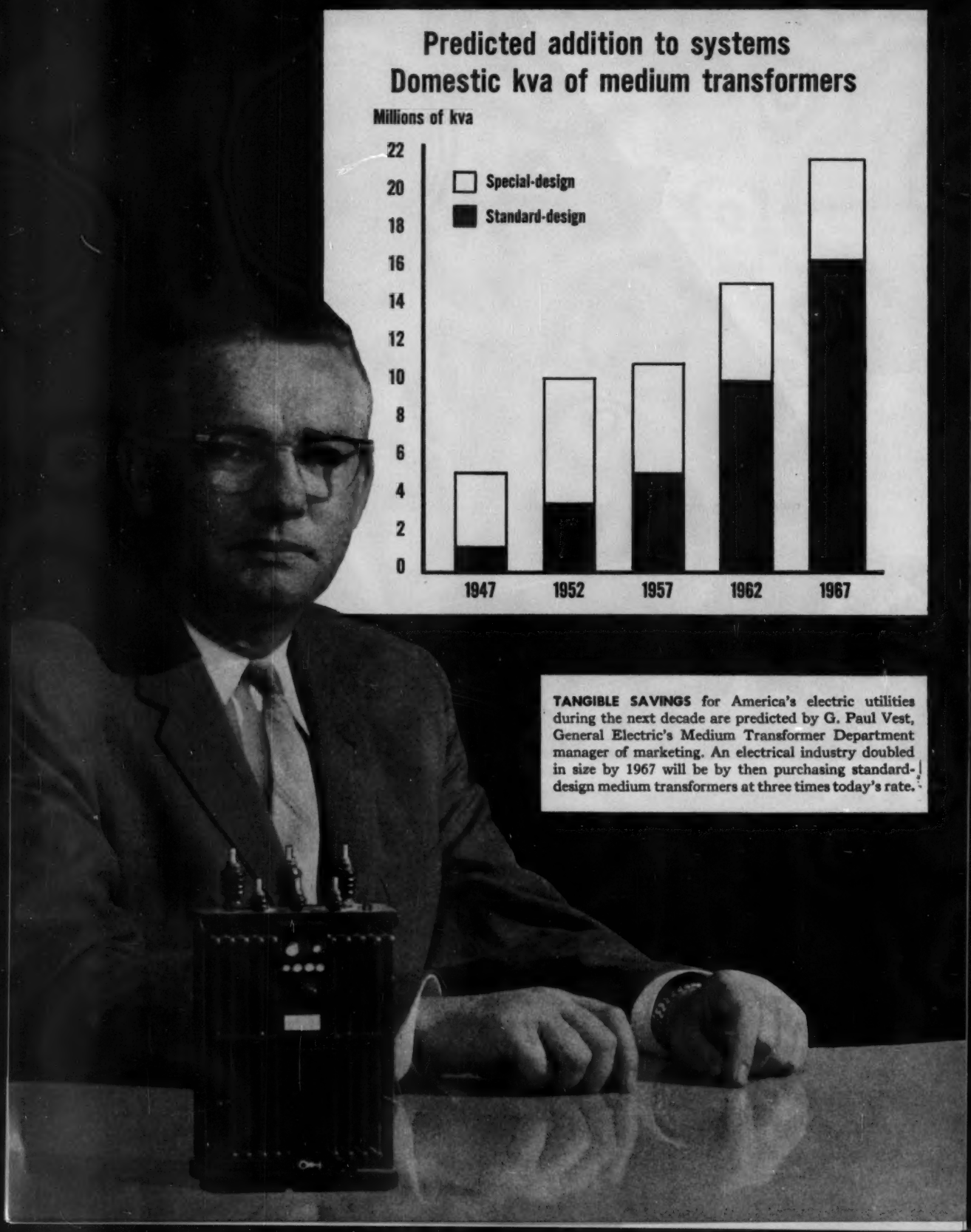
Our solution? We recess the bottoms of every General Electric 50-kvar capacitor. All that touches the ground is the heavy, double-thickness steel rim. The more vulnerable bottom rarely gets scratched or dented.

Please don't misunderstand us. We don't recommend dragging General Electric capacitors around. But we know that this can't always be avoided. So we've done something about it.

If you still have questions, get in touch with your General Electric Apparatus Sales Engineer. Or, write to General Electric, Section 445-4, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC



TANGIBLE SAVINGS for America's electric utilities during the next decade are predicted by G. Paul Vest, General Electric's Medium Transformer Department manager of marketing. An electrical industry doubled in size by 1967 will be by then purchasing standard-design medium transformers at three times today's rate.

HOW TO DESIGN • CONSTRUCT • OPERATE • MAINTAIN

A GENERAL ELECTRIC 10-YEAR FORECAST:

Tripled volume of standard-design transformers to bring savings to utilities

By 1967, an electrical industry doubled in size over the past decade will be purchasing standard-design medium transformers at three times today's rate. The industry will be realizing tangible savings by purchasing standard-design units direct from manufacturers' stock. So forecasts G. Paul Vest, manager of marketing at General Electric's Medium Transformer Department in Rome, Ga.

This prediction is based on continued acceptance of standard-design medium transformers by utilities. For, as acceptance of standard-design units grows, manufacturers can move toward production of "stock" medium transformers. These transformers cost 8 per cent less than specials and will save utilities over $40,000,000 during the next ten years.

Standard-design transformers also will relieve transmission-system engineers of time-consuming details of transformer design and specification.

YOU GET REAL BENEFITS *TODAY!*

But you don't have to wait 10 years to realize the benefits of standardization. You can obtain true economy, now, by specifying General Electric RM (Repetitive Manufacture) transformers. These standard-design units also offer:

Faster shipment—Ten-week shipment is now average for General Electric RM medium transformers. This compares with an industry average of more than 16 weeks for specials.

More and better features—Standard design makes it economically possible for G.E. to offer such extras as Formex* insulated windings, control-center arrangement of instruments and accessories, reversible junction boxes, and many others.

Higher quality for longer life—G-E repetitive manufacture techniques permit 18 assembly-line tests and 22 quality-control inspections during manufacture, to give more dependable operation over a long service life.

G.E.'S BROAD RANGE OF STANDARDS HANDLES 90% OF ALL JOBS

If your company is not yet taking full advantage of the benefits of medium transformer standardization, act today. Ask your G-E Apparatus Sales Engineer to show you how G.E.'s broad range of standard RM medium transformers can meet the large bulk of your needs, and also work efficiently with older, special transformers now on your system. General Electric Co., Schenectady, N. Y.

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Progress Is Our Most Important Product

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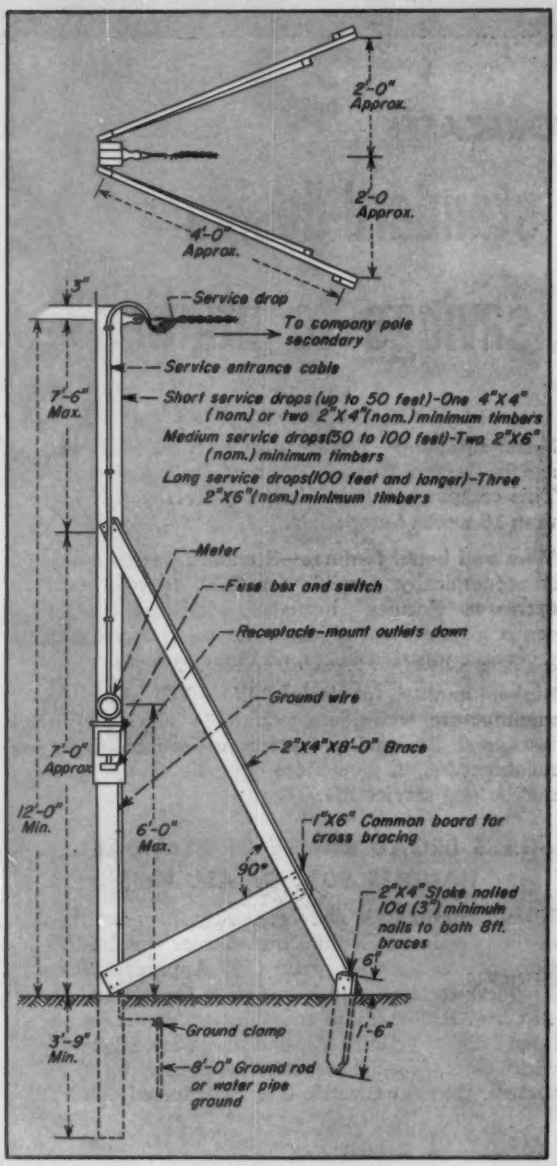

DISTRIBUTION—Construction

Temporary Service Setup Specified to Save on Costs

C. H. **WAGNER**, Distribution Engineering Section, American Gas & Electric Service Corp, New York, N. Y.

A temporary service installation, adequate in strength but not too costly, has been devised for those places where light construction power is required but permanent facilities for attaching service drops are not immediately available. This installation is the result of the combined thinking of men in the AG&E System operating companies and the Service Corp.

The installation consists of a braced timber column, the attachment for the service drop, a service-entrance cable leading to the meter, weatherproof fuse and switch box with receptacle, and a grounding connection.

The power company furnishes and installs the service drop, bracket or wire-holder, and meter. Other equipment is furnished and installed by the customer. The complete installation must meet the power company's approval.

The vertical column varies for short, medium, and long service drops. Up to 50 ft, one 4 by 4, or two 2 by 4's should be used. For 50 to 100-ft service drops, two 2 by 6's are prescribed; and for 100-ft or longer services, three 2 by 6's.

When the service drop must be attached higher than 12 ft above ground level, doubled braces—nailed together—are needed for stiffness. When available, a tool shed or other type support may be used for the service-drop attachment, if the support provides equal strength and proper clearances.

The service attachment must provide a minimum clearance of 12 ft above areas accessible to pedestrians and 18 ft above driveways, alleys, and public roads. Service drops exceeding 100 ft are not recommended, but where they are necessary slack-span construction should be used.

To facilitate conversion of this temporary installation to permanent service, a sufficient length of S.D. cable may be coiled and left hanging at the top, and a wedge-type clamp may be used for temporary dend-end.

DISTRIBUTION—Operation

Automatic Regulator Cuts Cooling Water 80%

HERBERT E. HAUER*, Engineer, formerly with New Orleans Public Service Inc, New Orleans, La.

Cooling water for network transformers in underground submersible vaults is controlled automatically by New Orleans Public Service Inc. The control scheme cuts water requirements by 80% yet permits a 33% increase in bank capacity.

The scheme consists of a temperature-sensitive switch in a bulb inserted into the transformer oil and an electrically operated solenoid valve. The switch is set at the factory to make contact at 150F, but an adjustment screw allows settings from 100 to 600F.

This switch controls a solenoid valve in the water inlet line. The valve opens when energized and closes when de-energized and may

(*Continued on page* 72)

* Hauer is now with Kaiser Aluminum & Chemical Corp, Chalmette, La.

Kellogg's Fabricating Abilities Keep Pace

Culminating many months of intensive work with Philadelphia Electric Company, including the testing and evaluation of numerous alloys, M. W. Kellogg is now fabricating the 2,400 ft. of main steam piping, which it will also install, for Eddystone Station Unit No. 1.

Piping is made of Type 316 Stainless, designed for use at 5,000 psi-1,200 F. at the turbine throttle. Calculated minimum wall equals 2.344 in. from Boiler to Sulzer Stop Valves (8 leads), 2.188 in. from Sulzer Stop Valves to Mixing Header (8 leads), and 2.656 in. from Mixing Header to Turbine (4 leads).

Kellogg's ability to handle the exacting task of bending, welding, heat treating, and testing such huge amounts of heavy-walled pipe to close schedules is a major reason for the company's long-standing reputation in the industry.

The M. W. Kellogg Company welcomes the opportunity to discuss its complete power piping design, fabrication, and installation facilities with consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.

M. W. Kellogg has developed many welding techniques for the fabrication of high alloy steam piping, including K-Weld*. With this unique technique of arc welding, the pipe interior is under controlled inert gas pressure —assuring complete root bead penetration and a highly uniform internal contour without the use of backing rings.

FABRICATED PRODUCTS DIVISION

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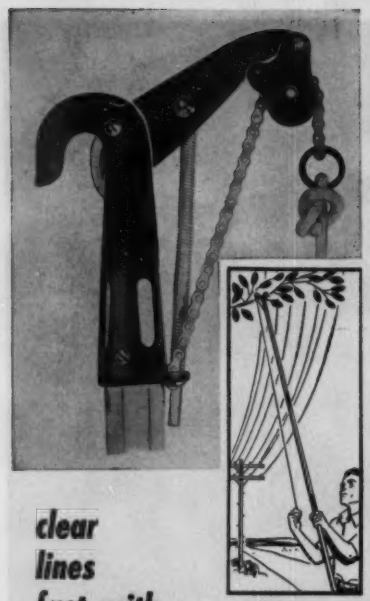
POWER PIPING—THE VITAL LINK

**Trademark of The M. W. Kellogg Company*



clear
lines
fast with...

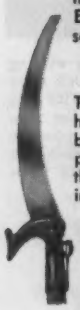
SEYMOUR SMITH
"Telephone" Tree Pruner

Here's the standard, the choice of the utility industry for years. Powerful action to cut cleanly—tough and almost unbreakable—easy to handle. No. 12 Pruner Head has 1½" cutting capacity. The lighter, No. 11, handles up to 1" branches. Both are malleable iron castings with tempered steel cutting blade.

Poles (18 ft. 3 sections) are of selected spruce with positive locking, seamless aluminum, telescoping ferrule joints.

FAST CUTTING PRUNING SAWS

Designed for fast, easy cutting—large, deep teeth, finest Swedish charcoal steel, streamlined, laminated hardwood handles. Every model you need up to chain saw work.



No. 20 POLE SAW HEAD

Tough aluminum head with large hook and outside horn for pushing branches, raising wires, etc. Also paint brush holder with wire clamp that holds brush securely. Fast-cutting 16" blade. Poles available.

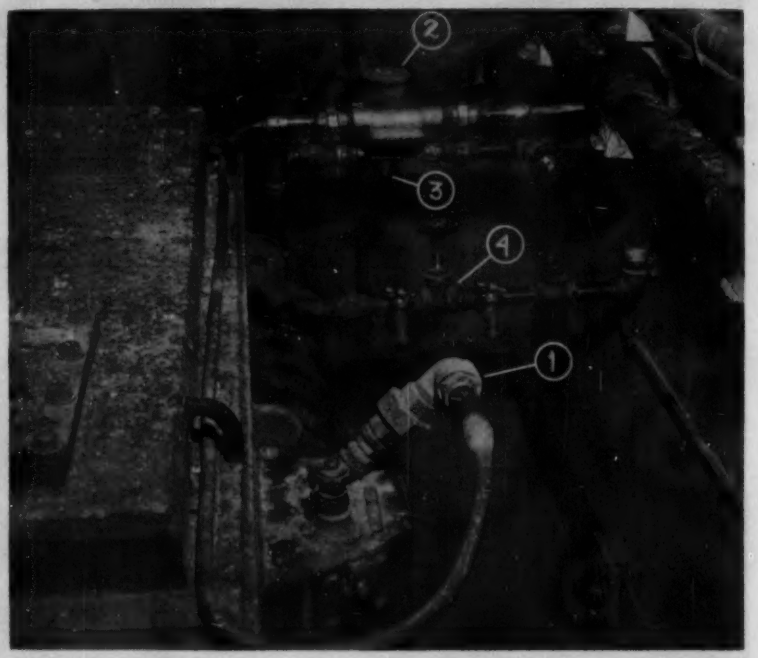
FREE: Send for Seymour Smith catalog pages on tools for utilities. Keep them on file for easy reference.

Quality Tools
SEYMOUR SMITH
Since 1850

SEYMOUR SMITH & SON, Inc.
2409 Main St., Oakville, Conn.

Cuts Cooling Water 80%

(*Continued from page* 70)



COOLING WATER CONTROL consists of temperature-sensitive switch (1) and solenoid valve (2) that cuts off water in the inlet pipe (3). Outlet water pipe (4) has valve and two faucets for checking of flow rate

be manually operated. Opened, the valve permits a water flow of about 7gpm. To adjust the flow to the required 3 gpm and permit a complete shut off of water, a hand-operated valve is connected ahead of the solenoid valve.

Water Is Strained

Also connected on the inlet side is a Y-type strainer which removes impurities.

Thus the water control scheme had to be waterproof. This was accomplished by selecting a moisture and explosion-proof valve and using lead-covered, rubber-insulated cable, which has two No. 10 conductors. The cable is wiped to a sleeve at all terminations. The bulb containing the switch is inserted in the oil through a thermometer well on the transformer.

To check the operation of the control scheme, several voltage and temperature charts were taken on an average installation. (The graphic voltmeter was used as a timer.) Resulting charts showed that water flowed about 10 min and was off 10 min during peak load in the afternoon. During the evening and morning the flow was on for 5 min and off for an hour, and from 9 PM to 10 AM the water was cut off. Thus, automatic controls cut water requirements to about 20% of the continuous flow quantity and to zero during cool weather.

Applications Are 56

Automatic regulation of water has been applied to 56 water-cooled transformers, of which 35 are 500-kva and 21 are 750-kva units. This represents about 25% of the total capacity of the network system.

Before adopting this water regulator, a vapor-pressure bellows was tried. It consists of a liquid in a bulb that is inserted in the transformer oil. As the oil temperature rose, the liquid vaporized, forcing the bellows to open a valve controlling the water flow. Tests brought out these disadvantages:

Lacked Positive Action

1. The regulator was difficult to set for the proper operating temperature. A half hour had to be allowed for it to reach stable operation after

(*Continued on page* 74)

CUT-AWAY VIEW OF
VICTOR NO. 729
(EEI-NEMA 58-7)
APPARATUS INSULATOR

BUILT TO TAKE A BEATING!

VICTOR Stacking Units are engineered to withstand extreme service conditions. Starting with proven design, VICTOR Apparatus Insulators are manufactured and tested with the industry's most modern equipment.

Purified Porcelain, coated with scientifically fitted glaze, gives these insulators maximum strength and service life. Utmost precision of manufacture and accurate alignment are attained by assembling shells with cap and pin in tempered, cast iron jigs. Components are carefully joined with a premium grade of insulator cement. Each insulator is tested mechanically, then subjected to vigorous high frequency and 60-cycle flashover. They are designed to withstand steep front impulse waves in addition to the normal 1.5 x 40 standard impulse wave.

Accuracy, ruggedness and exceptional service characterize VICTOR Apparatus Insulators. You just can't buy better stacking units—at any price!

Nothing beats Porcelain **FOR ELECTRICAL INSULATORS!**

VICTOR INSULATORS DIVISION

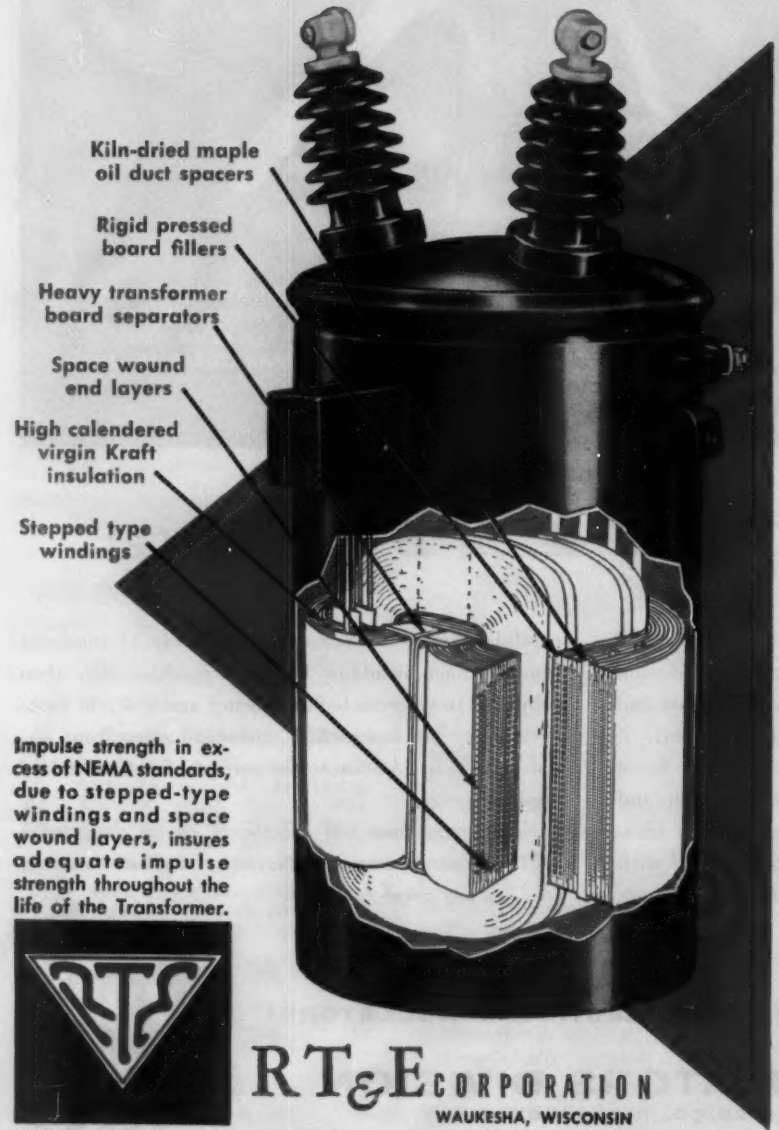
I-T-E CIRCUIT BREAKER CO., INC. • VICTOR, N.Y.

What Makes RT&E Transformers Better?

OUTSTANDING COIL DESIGN

High Overload Capacity
High Impulse Strength

RT&E core-type construction, combining maximum cooling surfaces with careful placement of oil ducts at critical points, results in faster cooling and a greater-than-average overload capacity. Mechanical strength of coils is enhanced with top quality varnish impregnation.


Kiln-dried maple oil duct spacers
Rigid pressed board fillers
Heavy transformer board separators
Space wound end layers
High calendered virgin Kraft insulation
Stepped type windings

Impulse strength in excess of NEMA standards, due to stepped-type windings and space wound layers, insures adequate impulse strength throughout the life of the Transformer.

RT&E CORPORATION
WAUKESHA, WISCONSIN

OUTSTANDING COIL DESIGN — *Another reason why* **RT&E** *is better!*

Cuts Cooling Water

(*Continued from page* 72)

each trial and error adjustment.

2. The charge in the regulator had to be checked and renewed periodically.

3. The regulator was designed for throttling operation primarily, rather than positive opening and closing.

GENERATION—Operation

Dumps Condensate, Boosts Unit Output

BART MONTIEGEL, Asst. Plant Manager, Kyger Creek Plant, Gallipolis, Ohio

Much of a generator's capacity is unavailable during the starting up of a unit after an outage. This capacity is unavailable because the generator's loading is determined by the boiler pressure which is raised incremently above 1,000 psi in proportion to the silica content of the boiler water.

Condensate 'Overboarded'

As silica contamination is usual during load reductions and outages, much full-capacity time is lost during the startup of each unit.

To help reduce this lost full-capacity time, the contaminated condensate is "overboard" to the discharge tunnel, and boiler feedwater is drawn from the condensate storage tank during the startup period. The short 4-in. pipe, with one valve between the condenser flooding line and the suction of one condensate booster pump, was the only change necessary.

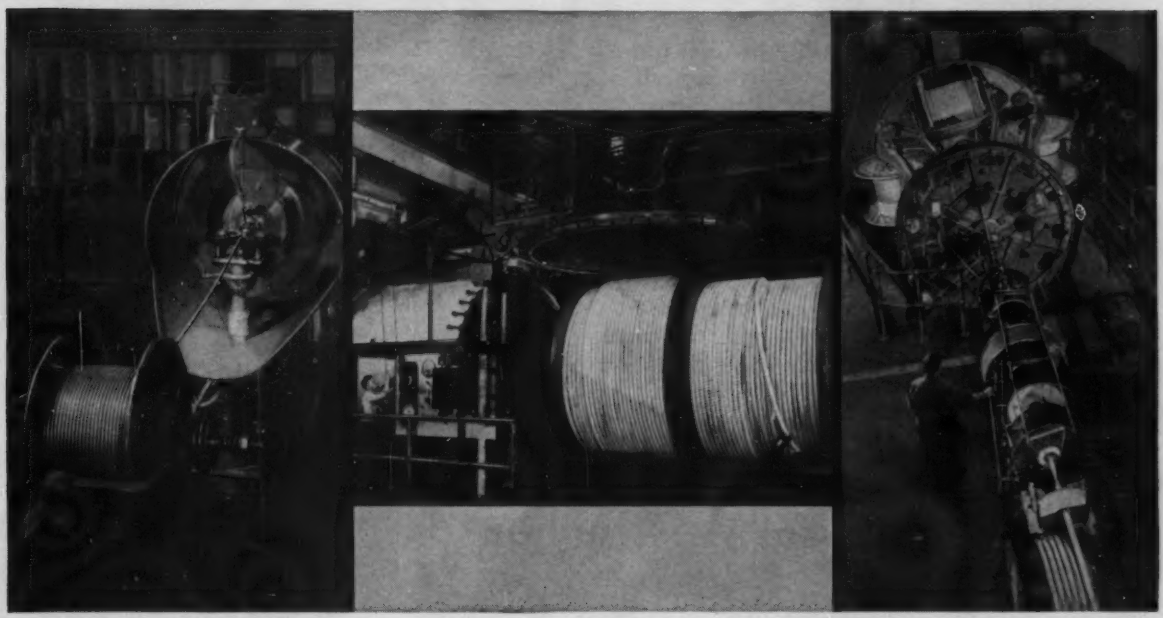
Washing Made Safer

Tests and time studies have shown that full-boiler pressure and full generation is obtainable in a much shorter time through dumping contaminated condensate. Furthermore, turbines can be washed now during reduced-load periods without too much ill effect on boiler feedwater. After a successful washing, 1,000 to 2,000 kw additional capacity is obtained on each turbine-generator.

GENERAL CABLE

PAPER INSULATED
VERSATILE · RELIABLE
POWER CABLES

Manufactured at BAYONNE, N. J. • ST. LOUIS, MO. • EMERYVILLE, CALIF.



This machine forms steel strip into helical coil ducts or channels for use in gas filled or oil filled cable.

Impregnating Tank utilized in the heat-vacuum drying and oil impregnation steps in the manufacture of Paper Power Cable.

Large Cabling Machine used in cabling individually insulated conductors into multiple conductor assemblies.

- **SOLID TYPE**
- **LOW PRESSURE GAS FILLED**
- **LOW PRESSURE OIL FILLED**
- **PIPE TYPE**
  - **High Pressure Gas Filled**
  - **High Pressure Oil Filled**

The excellent operating record over many years and the superior electrical characteristics of paper insulated cable highly recommends its use for all power applications. Paper Power Cable is a predominant type in preference and use for voltages above 5 KV.

General Cable Corporation is equipped with the finest modern facilities for paper taping and with many years of know-how is in a position to supply a high quality product for all low and high voltage applications.

GENERAL CABLE CORPORATION
420 Lexington Avenue, New York 17, N. Y.
Offices and Distributing Centers Coast-to-Coast

for quality and economy... **specify GENERAL CABLE**

Save $2920*

New APT high-voltage potential transformer . . .

greater metering accuracy, 50% more thermal capacity than other low-cost designs

The new Westinghouse Type APT potential transformer is designed for low-cost, positive protection and highly accurate metering. Its single-core-and-coil, single-bushing design holds the edge over both the conventional type and other low-cost designs.

Greater metering accuracy—This new transformer, 92-161 kv meets ASA 0.3 accuracy standards on burdens up to 500 volt-amperes; and, as shown in the graphs below, at 200 volt-amperes burden both its ratio correction factor and its phase angle deviation are only half as much as for other low-cost designs. This means more accurate metering under all conditions.

Higher thermal rating—The Type APT transformer at 115 kv, for instance, has a minimum thermal rating of 6000 volt-amperes.

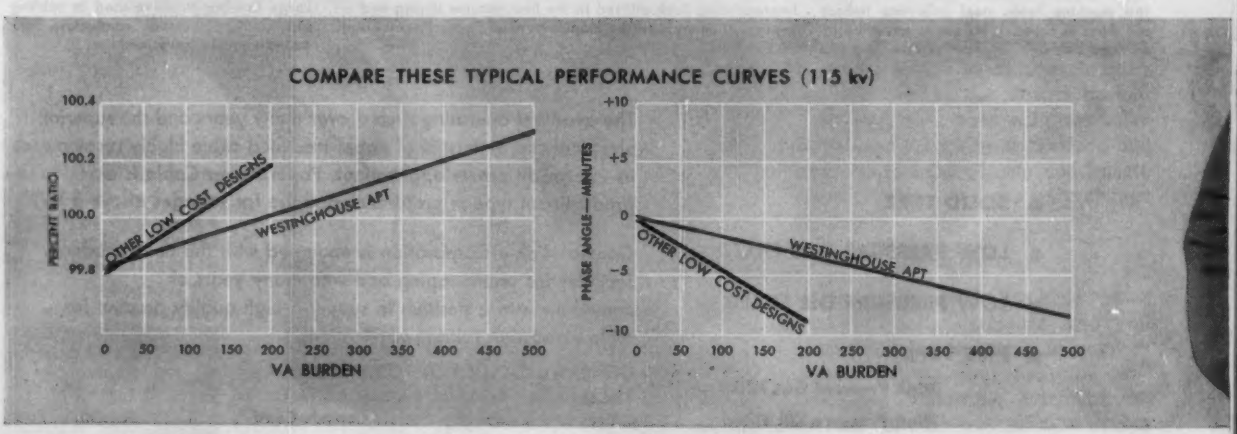
ASA Group 3 insulation—Designed for line-to-neutral operation, the APT utilizes Hipersil® cores fluxed for line-to-line voltage under emergency operating conditions.

Reduced size and weight—Solid insulation and exclusive Hipersil cores combine maximum performance characteristics with minimum size and weight.

For the full story of the performance of the Type APT transformer, call your Westinghouse representative . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

*On a 138 kv APT potential transformer J-70818

YOU CAN BE SURE...IF IT'S Westinghouse



Lower percent ratio error and smaller phase angle deviation of new Westinghouse APT potential transformer contribute to substantially improved metering accuracy.

45% savings

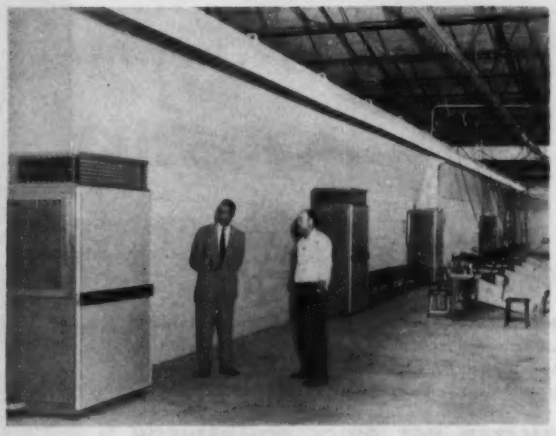
New Type APT potential transformer, available in voltage classes from 92 through 161 kv, meets all ASA standards for high-voltage metering and relaying applications, and offers the following savings:

ESTIMATED NET PRICE COMPARISON

Insulation Class	BIL kv	Conventional Design	Westinghouse Type APT
92 kv	450	$4080	$2230
115	550	4930	2690
138	650	6460	3540
161	750	8110	4460

How Heat Pumps Helped Spur Area Development

Appalachian Electric helps bring life-giving industry to rural Virginia community by using heat pumps to reduce plant building costs



PACKAGED HEAT PUMPS, located along walls, helped cut building construction costs, save space, and reduce ductwork

JAMES B. WHITE, District Commercial Manager, Appalachian Electric Power Co, Abingdon, Va.

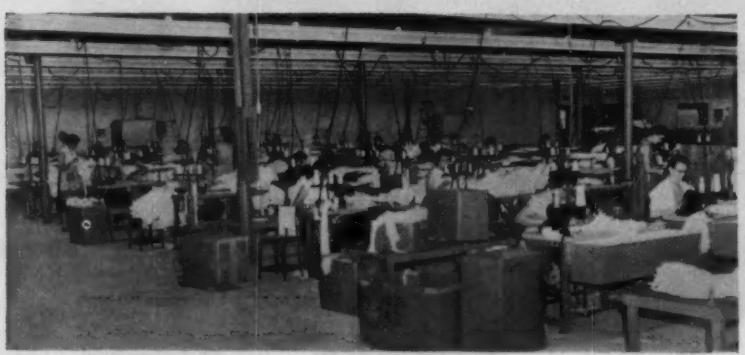
Area development got a lift when one of the largest industrial plant heat pump installations in the country went into operation recently in a community-built textile plant in Lebanon, Virginia.

Appalachian Electric Power Co played a major role not only in the sale and installation of the 14-unit heat pump job, but also in the locating of the new plant in this town.

The plant, which produces ladies' undergarments, is operated as Russell Mfg Co, a subsidiary of Top Form Mills, Inc., of New York City. It came into existence as the result of a community sponsored organization, Little Cedar Building Corp. Little Cedar is a local industrial development group which raised $150,000 through local stock sales, bank loans, and with a contribution from the manufacturer to build the plant. Appalachian's area development department worked closely with this local group.

The fact that there were three groups involved in the plant construction and operation made the job of selling a heat pump installation very difficult. All three had to be satisfied: Little Cedar Building Corp for original installation cost; Russell Mfg and Top Form Mills Officials for operating cost; and architects from a design standpoint.

We met with representatives of all of these groups singly and together on several occasions. Finally, bids were let for the building on the basis of a coal-fired heating system and conventional forced ventilation. All bids were in excess of the budget set up by the building corporation.



MANUFACTURING AREA buzzes with activity as a result of incoming orders. Dresses being turned out here mean income that heat pumps gave to Lebanon

An Appalachian representative again suggested the installation of a heat pump system, which could result in a reduction of window area and consequently, construction costs. Appalachian was asked to design a heat pump installation and secure bids on it. The low-bidder contractor was asked to resubmit his bid on the basis of certain revisions, including deletion of all windows in the manufacturing area. After about two months work with the general contractor, the architect and several sub-contractors, an acceptable bid was received for the heat pump installation and the building.

Windows only in Offices

There are windows only in the front of the building where offices are located. Using heat pumps obviated the necessity for windows in the other three sides of the building and thus helped cut costs.

The plant is completely electrified. Our engineers, working with the architects and contractors designed the electrical system for the 33,000 sq ft building. This included the lighting system, trolley ducts for the sewing machine power feeds, and the heat pumps.

Entrance for the plant is 1,200 amp. This is made up of two 600-amp parallel main disconnects and two allied breaker panels. Heat pump installation is fed from one of the 600 amp disconnects; the

(*Continued on page* 82)

DESIGNED FOR ALUMINUM

HIGHEST QUALITY

FARGO "9000" SERIES

"One-piece" aluminum connectors

CAREFULLY INSPECTED

UNIFORM DEPENDABILITY

EASY TO USE

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Bimetal inserts of pressure welded aluminum and copper sheet. Excellent conductor encirclement and separation.

FOR ALUMINUM TO ALUMINUM

Pure aluminum spacer gives high conductivity. Extra wide contact surfaces. Large mass for heat dissipation.

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Manufactured by
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FARGO

SANGAMO CAPACITORS

Sangamo's power capacitor engineering is more than skin deep. It's so complete and thorough that all designs have assured factors of safety to meet every operating condition. Insurance that Sangamo power capacitors will give better performance—longer life.

Extensive high voltage test facilities enable establishment of better than usual 60 cycle withstand and impulse voltage levels. Fully instrumented, precise powered heat run tests give the facts for optimum design with low operating temperature—and continuing life tests under actual operating conditions provide the final criterion for well-balanced liberal design.

High-voltage test berth includes equipment for 60 cycle withstand tests, impulse tests and corona measurement.

..long life assured

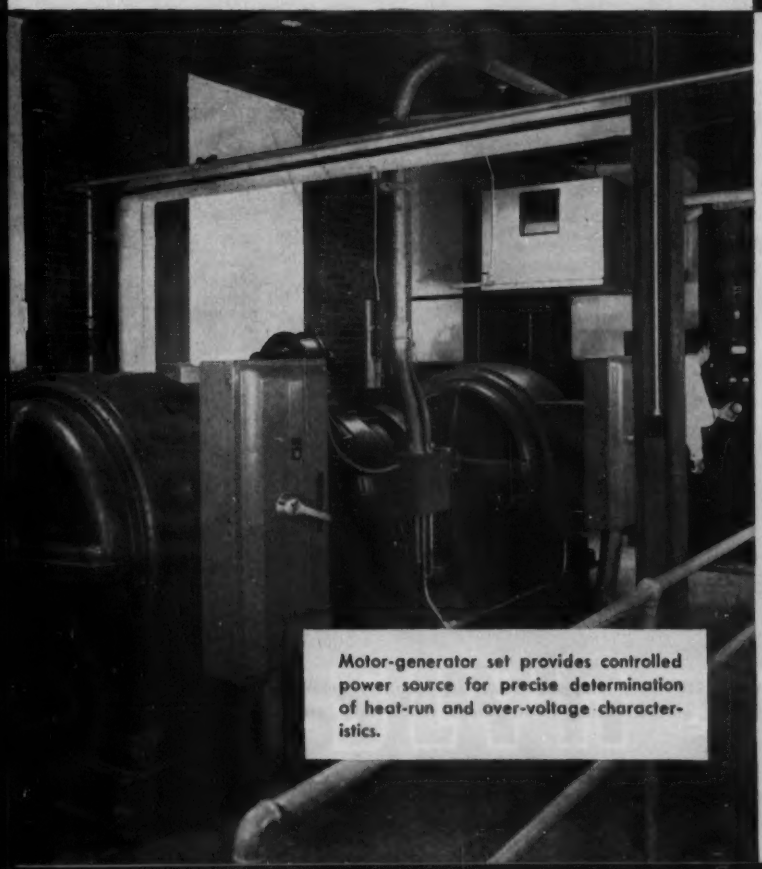
These test facilities, combined with Sangamo's many other facilities and advanced manufacturing methods, give you full assurance that Sangamo power capacitors will be your best buy.

Fine engineering and manufacturing facilities are among the reasons why inspection of Sangamo manufacturing operations by power engineers from a large number of the country's major utilities has resulted in unqualified product approval. Why many have said "This is the best capacitor operation I have ever seen."

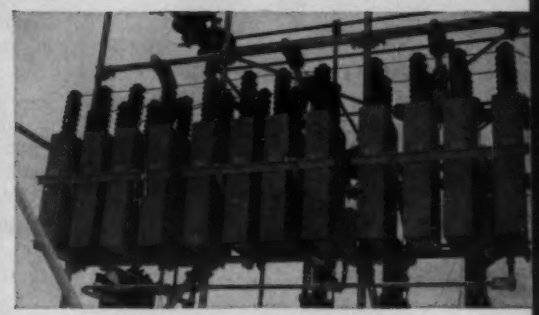
SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

PC57-4

Special test setups duplicate service installations. Here pole-type equipment is checked for mechanical construction, electrical clearances and operating temperature characteristics.



Motor-generator set provides controlled power source for precise determination of heat-run and over-voltage characteristics.



Capacitors designed for assured long life in a highly contaminated area feature stainless steel cases and specially designed "high creep" bushings.

NEW

high-speed high-power lightweight

CONDUIT BENDER

GREENLEE

No. 884 HYDRAULIC BENDER

- *90° bend with one ram stroke*
- Bends 4″ conduit 90° in 4 minutes with No. 798 Power Pump shown
- Handles 10 conduit sizes ½″–4″
- One man wheels it from job to job on its specially designed pipe supports
- Fast setup and operation by one man
- Two-speed power pumps for fast approach . . . 90° bend in 4″ conduit as fast as 30 sec with No. 797 Pump
- High-strength aluminum and steel construction for minimum weight, maximum strength
- Universal pipe supports rotate to handle all conduit sizes
- Front insertion and removal of conduit
- A dozen advanced features

WRITE FOR BULLETIN E-224

GREENLEE TOOL CO.

1809 Columbia Ave. • Rockford, Ill.

manufacturing and lighting loads from the other. There is reserve capacity in the electrical system for additions to both loads if required.

The 14 heat pumps are located around the interior perimeter of the building. Four additional units may be added when needed.

There is very little duct work in the job. In fact only four units have ducts connected to them. One of these is used to condition the offices which are partitioned off from the main manufacturing area. Three units have ducts serving the middle of the manufacturing area.

The concrete block building has a flat built-up roof made of 1-in. rigid fiberglass insulation and two in. of lightweight aggregate reinforced concrete. A light color aggregate was used on the roof for its high reflective value in reducing the structure's heat gain. The interior walls of the building have been painted white with a waterproofing cement which helps to provide a high-illumination reflectance factor.

Lighting, too, Is Good

For lighting levels, our engineers recommended 60 ft-candles for the manufacturing spaces and 50 ft-candles for the office. These recommendations were followed almost to the letter. In the manufacturing area, fluorescent fixtures in continuous rows are used above the sewing machine production lines.

The plant has been in operation since June. At that time a public open house was held and more than 1,000 people toured the plant. Operations were continued during the tour, which was held on two warm, humid days. Visitors remarked that "the plant was the coolest, most comfortable place in the county".

Plant officials and employees are very enthusiastic about the heat pump system. Plant officials say that even though the women in the plant are recently trained, production is high. They attribute part of this to the excellent working conditions. They are also pleased with the operating costs of the heat pumps.

Demand and Energy Metered

Demand and energy check metering is provided on the circuit feeding the manufacturing and lighting load. These readings are subtracted from totalizing meters to determine the heat pump load.

Appalachian's estimate of annual operating costs for the heat pumps was based on a building of 25,000 sq ft and ten units. These estimates were $1,540 for cooling and $1,606 for heating. However, the building was enlarged to 33,000 sq ft which upped the total to 14 heat pumps. No new operating cost estimate was made. Appalachian engineers report that, based on their early estimates, operating costs during the cooling season are well in line. Because the plant has not yet been through a heating season, complete operating costs are not available.

Connected load for the entire plant is now 162 kw. There are about 150 sewing machines in operation. It is expected that in the next several months the number of machines will be increased to about 350, which would mean an employment jump to 400 persons from the present 170.

(More Selling on page 84)

WINDOW COSTS were chopped down by locating them only in front wall of building near offices. Using heat pumps made this type construction possible

JOSLYN announces the addition of a VALVE ARRESTER to its line of protective equipment.

Over 20 years ago Joslyn introduced a new expulsion arrester to meet the urgent need for trouble-free, effective performance under severe lightning conditions. The unequalled service record of more than 2,000,000 of these arresters continues to demonstrate direct-stroke protection and the validity of the claim . . . POSITIVE PROTECTION . . . as applied to Joslyn Expulsion Arresters. The unimpeded discharge path of these arresters, which makes possible this outstanding performance, brings with it fault-current limitations:

The extraordinary growth in the use of electricity in recent years has required the capacity of power systems to be increased beyond all predictions, particularly in dense urban areas. In such areas, the fault-current ratings of expulsion arresters may be exceeded . . . also, their severe lightning capabilities are not needed because of extensive shielding. On the other hand, valve arresters are suitable for such applications because their built-in resistance element makes them insensitive to fault-current magnitude . . . also, their reduced protective ability is not detrimental because of limited lightning duty in dense urban areas.

Seeking one arrester to meet the diverse requirements of severe lightning and excessive fault current, Joslyn initiated a research program five years ago to determine if recent advances in the physics of solids, particularly semi-conductors, permitted the design of an "all-purpose" arrester; and if not, to develop a superior valve arrester. This research has not disclosed a new valve material to attain the "all-purpose" arrester . . . but advanced knowledge gained has enabled the design of a substantially improved silicon carbide valve arrester.

The Joslyn Valve Arrester incorporates improvements in the two basic components of a valve arrester:

I. Arc Quenching System

a. Circular gap structure produces magnetic blow-out—gives necessary arc elongation proportional to current magnitude without auxiliary coils and surge by-pass means

b. Horizontal gaps prevent short circuiting by beading—preserve initial gap spacing

c. Inner-structure vent holes prevent arc-generated metallic deposits from shorting critical gap insulation

d. Capacitance plates establish uniform voltage distribution across gaps

II. Valve Element

a. Selected grain sizes give high density element with exceptional heat capacity

b. Silicon carbide, without cement or binder, improves stability against decomposition and channeling

The Joslyn Valve Arrester is a superior valve arrester.

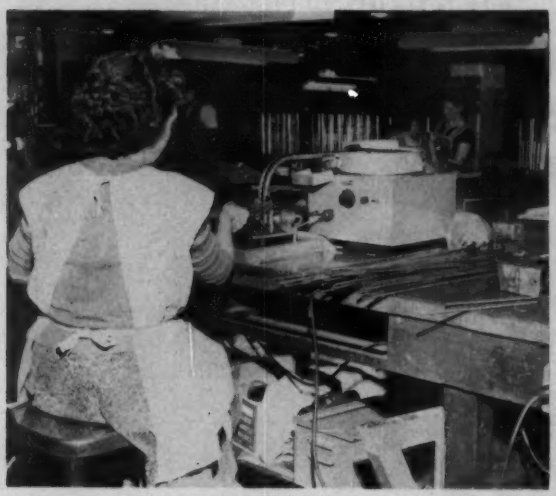
. . . Laboratory tests, far more severe than industry standards, have proven its qualifications.

. . . Two years of field service have demonstrated its ruggedness and reliability.

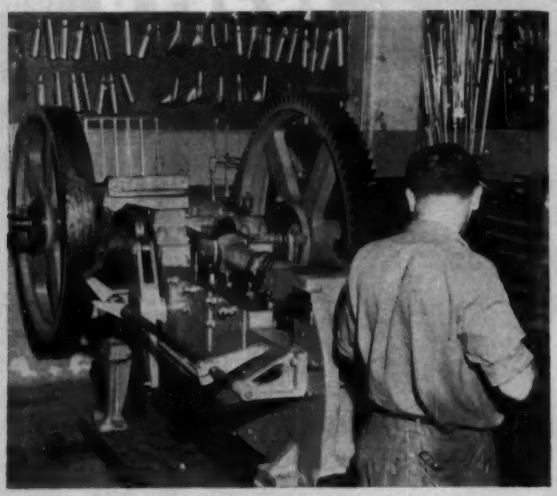
JOSLYN MFG. AND SUPPLY CO.

155 N. WACKER DRIVE • CHICAGO 6, ILLINOIS

JOSLYN COMPLETE POLE LINE EQUIPMENT



NOVEL DEVICE AUTOMATICALLY applies plastic ball to end of brass or aluminum wire, is used to produce TV antennas



HORIZONTAL TAPER SWADGE PRESS has tripled output on one job. Powered by 15-hp motor, it tapers both ends of tube

Mechanization Doubles Tube Plant Output

Increased efficiency and improved product quality are two of the principal benefits of an extensive mechanization program recently completed at the Bellevue Tube Co, Philadelphia, Pa. Using a wide variety of automatic and semi-automatic machinery, Bellevue forms and finishes steel and brass tubing both for its parent company, Snyder Mfg Co, and for outside contractors.

With the mechanization, production has risen 100%. Contract work for distributors has increased. Outside contractors can now get delivery of some items in half the time required as recently as one year ago.

Oven Boosts Production 200%

Among the new equipment is a continuous process painting and baking conveyor which handles as many as 5,000 TV tables of various designs each day. This is an increase of approximately 200% compared to the method previously used. Operating from a 2,300-volt line, the oven uses six heaters. A thermostatic control holds the inside temperature at approximately 40F. Most of the finishes are synthetic enamels.

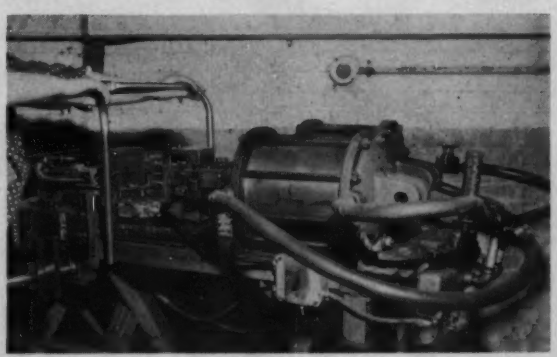
Coming from a forming operation, the pieces are carried into the painting area by an overhead conveyor system, driven by a 5-hp motor. The same conveyor system carries the wet pieces into the oven for baking.

Typical of the new machinery is a large, horizontal taper swadge press that is completely automatic. It tapers steel tubes at one or both ends quickly and uniformly, requires only one operator. Before the new machine was installed, material was inserted by hand into a rotary swaging machine. Capable of handling material 18-inches long and 3-inches in diameter, the big press is driven by a 15-hp motor. The new swadge has tripled production.

Newest piece of equipment is a semi-automatic machine that bends steel and brass tubing to the desired shape and simultaneously pierces the ends for assembly. A 3-hp motor powers it. Other new equipment includes a semi-automatic roll threader, driven by two 3-hp motors, an automatic beading machine for auto radio antennas, and another battery of tube bending and forming machines, with motors ranging from ½ to 10 hp.

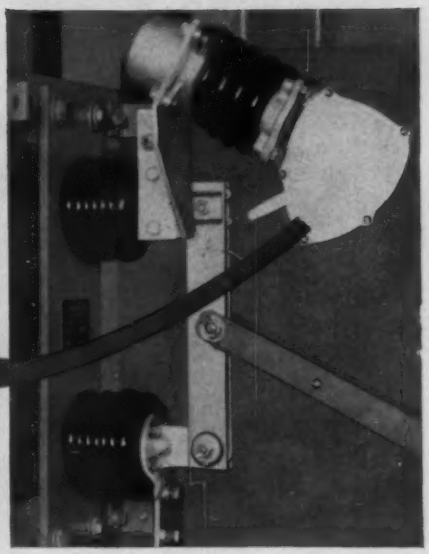
A special machine, designed by Gus Snyder, vice president in charge of production for Bellevue and Snyder, is an automatic ball attaching machine for indoor TV antennas. It attaches a plastic ball to the end of brass or aluminum wire at the rate of 800 pieces per hour, utilizing an a-c vibrator.

When the modernization program was started three years ago, primary consideration was product uniformity and quality. Increased production was secondary. Because of the success at Bellevue, the company is now considering similar programs for its other plants.



STEEL AND BRASS TUBING for TV tables is automatically bent to shape and pierced for assembly by 3-hp machine

Now...Safe, positive interruptions for cubicles and unit type substations



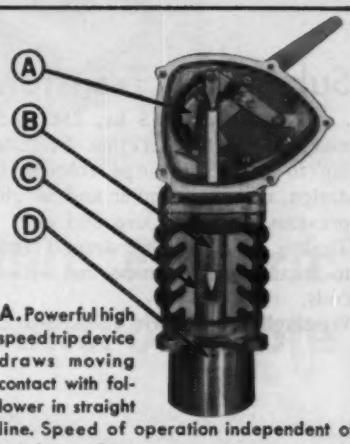
DELTA-STAR POWERUPTER

Breaks rated load instantly and decisively... eliminates danger to men and equipment through accidental operation!

The Delta-Star Powerupter combines an improved interrupting device with the most modern of disconnecting switches and an exclusive automatic trip mechanism that makes or breaks instantly and decisively.

Powerupter is ideal for use in small enclosed spaces because there is no danger of phase-to-phase or phase-to-ground faults AND NO EXTERNAL ARC. For the same reason, there is no danger to men or equipment if the unit is accidentally operated.

Powerupter switches are also available in combination with fuses ...in voltage ratings from 7.5 thru 34.5 kv with 600 amp. interrupting capacity, and continuous current ratings of 400, 600, 1200 and 2000 amperes. For further information, write Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton Street, Chicago 12, Illinois.



A. Powerful high speed trip device draws moving contact with follower in straight line. Speed of operation independent of switch speed.

B. Arcing chamber lined with gas evolving material encloses both stationary and moving contacts.

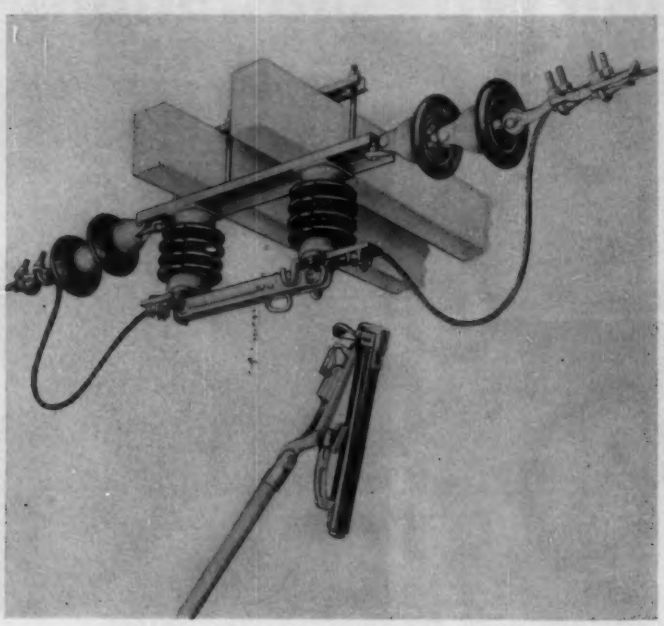
C. Follower of gas-evolving material, drawn up into arcing chamber to insure rapid extinction for all current values.

D. Exhaust chamber muffler confines and cools exhaust gases released from interrupting chamber.

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Divisions of H. K. Porter Company, Inc.: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.



Disconnect Switch . . .

. . . **interrupts 400-amp load safely** when used with "Loadbuster", a portable loadbreak tool. The "Tool Operated Disconnect" is rated at 15 kv, 400 amp. It will withstand 95 kv impulse (110 kv for heavier types), momentary current of 20,000 amp.

Disconnect and "Loadbuster" combination reduces cost of distribution load switching, since the tool can be carried to the disconnect when needed.

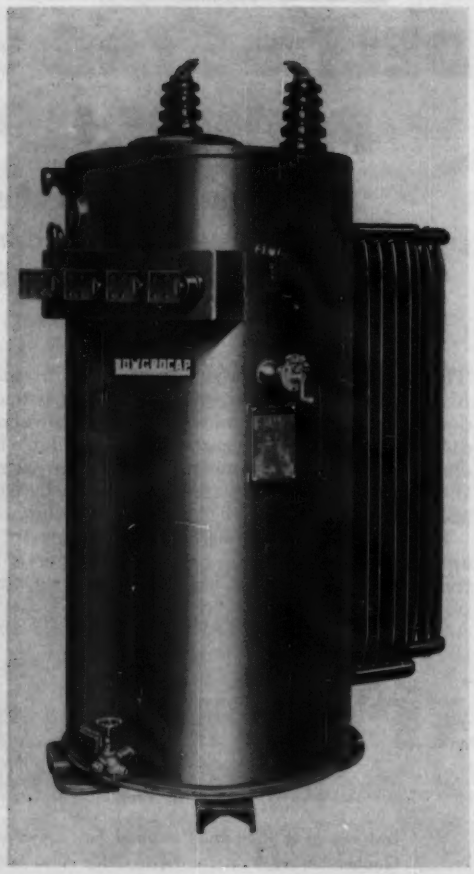
Other features are: heavy-duty channel base, large bearing surface of base to prevent cross-arm damage, four-bolt mounting, dead-ending without extension links, two-stud insulator, large leakage distance, 10½-in. disconnect gap, and silver-to-silver contacts. Connectors take aluminum or copper.

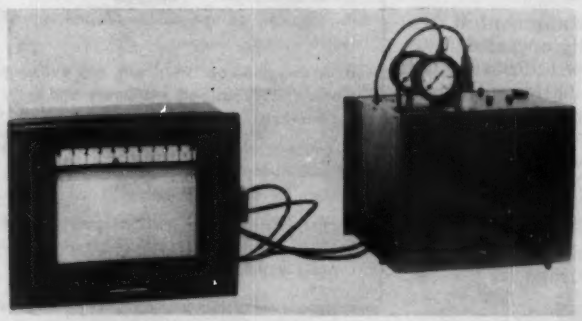
S&C Electric Co, 4435 Ravenswood Ave, Chicago 40, Ill.

Substation Transformers . . .

. . . **Rated up to 15 kv, 250 to 500 kva,** single phase, make up new type LD line. Featuring "Lowgrocap" winding to distribute surge voltages evenly and "D" core design, they are smaller and weigh up to 25% less than previous models. Core and coils are fastened to base. Tank is sealed by weld around bottom, making it possible to untank unit for inspection without disturbing core and coils.

Westinghouse Electric Corp, Box 2099, Pittsburgh, Pa.

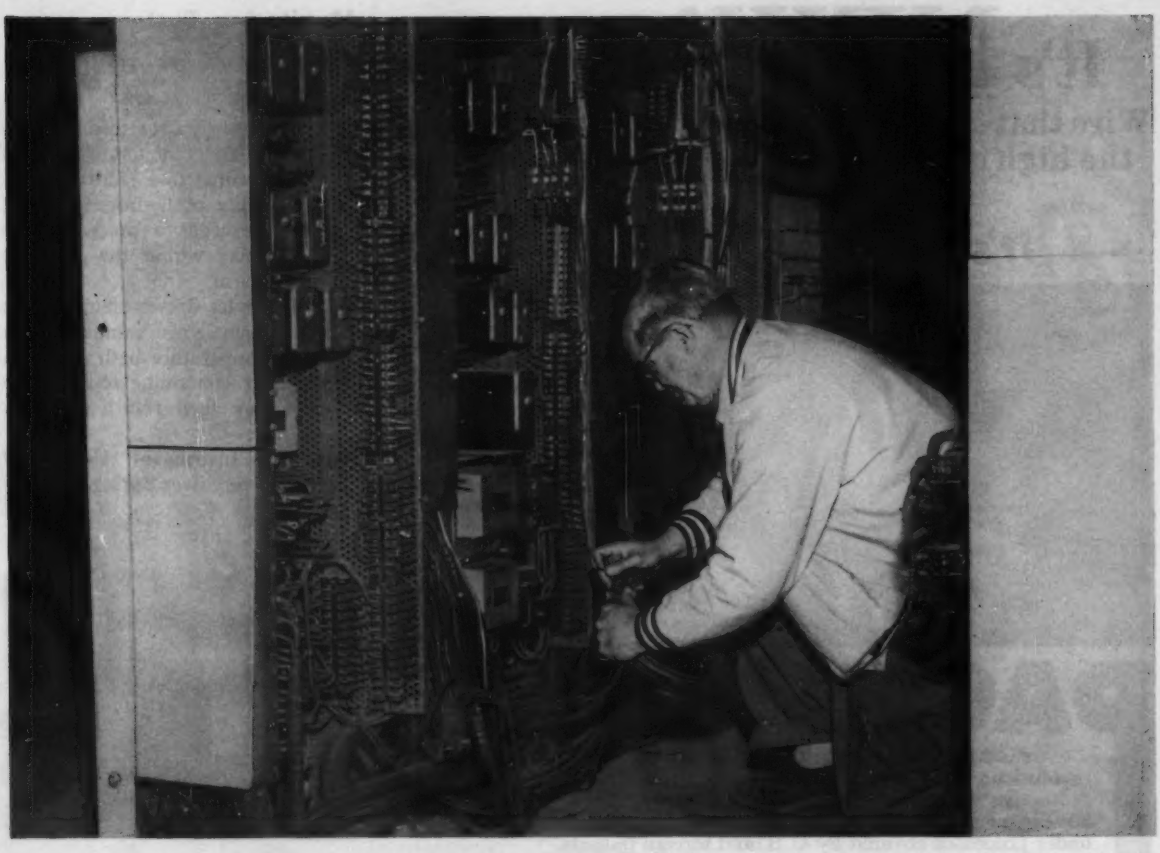




Monitoring System . . .

. . . **for hydrogen-cooled generators** records amount of moisture present in hydrogen coolant, and sounds alarm if it is excessive. Sensing stations sample moisture content continuously, and detect dew-point before and

(*Continued on page* 88)



Workman installs neoprene-jacketed control cable in 138,000 volt control switchboards of the new substation.

FOR ITS LARGEST SUBSTATION

Columbus & Southern Ohio Electric uses neoprene-jacketed control cable

The Marion Road Substation of Columbus & Southern Ohio Electric Co. is one of the largest substations on their system. This 80,000 KVA station in Columbus, Ohio, links 138,000 and 40,000 volt transmission lines and 13,800 volt feeders. The control cable—both single and multi-conductor—is jacketed with neoprene.

Neoprene is ideal jacketing material for control cable. It is resistant to flame, ozone, oil and aging. It also guards outside installations because it resists sunlight and weather, chemicals, heat, flex cracking, abrasion and cutting. Of all resilient materials, only neoprene has this balance of properties to assure dependable service and lower maintenance costs.

Ask your supplier about wire and cable jacketed with neoprene. It's available in single and multiple conductor types and voltage ratings to meet your requirements. Mail the coupon below to get the ELASTOMERS NOTEBOOK with actual on-the-job reports of neoprene's performance in a wide range of industrial products.

DU PONT

Better things for better living
. . . *through chemistry*

NEOPRENE

— made by Du Pont for 25 years

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. EW-9-2
Wilmington 98, Delaware

Please put my name on the mailing list for the Elastomers Notebook.

Name_____

Position_____

Firm_____

Address_____

City, State_____

MAIL THIS COUPON NOW . . . WHILE YOU'RE THINKING ABOUT IT

It's NEW!

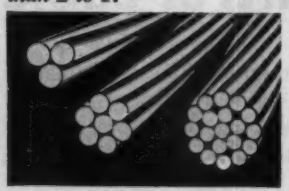
Wire that combines the strength of steel with the high corrosion resistance of aluminum

It's ACCO *Aluminized!*

PAGE STRAND

PAGE has successfully combined two time-tested metals into a revolutionary new wire—ACCO ALUMINIZED—that has a ductile, protective coating of aluminum *bonded* to iron and steel wire by a hot-dip method. This product is covered by and is manufactured under processes covered by U.S. and foreign patents.

Now PAGE offers ACCO ALUMINIZED Steel Strand for guy wire, ground wire and messenger wire applications. Can be used with Preformed Guy-Grip dead-ends made of ACCO ALUMINIZED Wire, or with galvanized pole hardware. Here is evidence of ACCO ALUMINIZED Steel Strand's superiority: salt spray tests conducted in strict accordance with ASTM procedures show that, for equal thickness of coating, aluminized *outlasts galvanized by more than 2 to 1.*

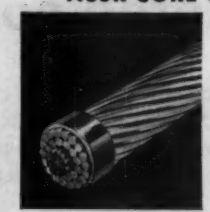


ALL STANDARD GRADES

PAGE ACCO ALUMINIZED Steel Strand is available in Common, Siemans-Martin, High Strength, Extra High Strength and Utility grades with physical properties meeting ASTM Spec. A-122-54-T and A-363-55-T.

NOTE: We will continue to make and market PAGE Stainless Steel Strand and PAGE Galvanized Strand, as heretofore, in 3-, 7- and 19-wire construction.

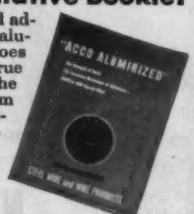
Also... PAGE *Aluminized* ACSR CORE WIRE



Aluminum Conductor Cable with PAGE ACCO ALUMINIZED ACSR Core Wire is now available from many manufacturers of conductor cable. Product quality control is assured by a special testing procedure mutually developed by PAGE and ALCOA.

Send for Informative Booklet

How about ductility and adherence properties of aluminized wire? Why does aluminizing create a true duplex coating over the core? How does aluminum "sacrifice itself" to provide electrochemical protection? For answers, write us at Monessen, Pa., asking for **Booklet DH537-A.**



ACCO for Better Values

Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

ACCO

Monitoring System

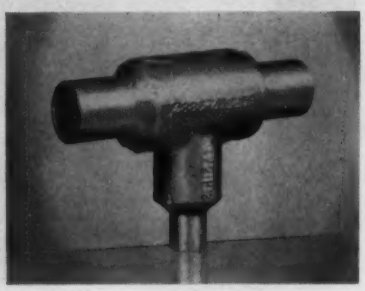
(*Continued from page* 86)

after hydrogen passes through drying unit. Dew-point temperature is then transmitted to a recorder.

If humidity of hydrogen leaving the drier exceeds a pre-set safety limit, a relay within the recorder actuates alarm.

Gas samples drawn off main line pass through coils submerged in constant-temperature bath and then to chamber containing sensing element. They then return to main line.

American Instrument Co, 8030 Georgia Ave, Silver Spring, Md.



Wrap-Around Connector . . .

. . . aids in welding aluminum bus. Connection is made by clamping the cylindrical fitting around bus ends and welding. As weld cools, polished inside surface of connector contracts tightly around bus, giving good conductivity and strength. Polished surface and tight connection also eliminate oxidation of bus. Metal mass minimizes annealing.

Installation costs are reduced because tolerances of bus joining are not critical. The "T" fitting can be adjusted to exact 90-deg alignment, and can be used as a "coupling T."

Schwager-Wood Corp, 8024 SW 35th Ave, Portland 19, Ore.

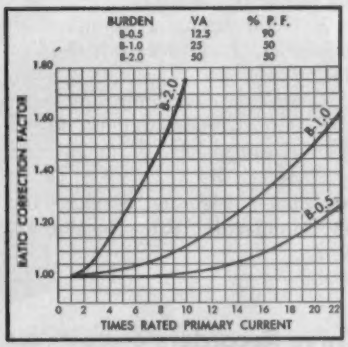
Motor Starters . . .

. . . in 2,300- to 4,160-v line permit full or reduced voltage starting, reversing or non-reversing, dynamic braking or multi-speed control of squirrel-cage, synchronous,

(*Continued on page* 90)

NEW 5-Kv Molded CURRENT TRANSFORMER

...for Indicating and Tripping Service



Typical 60-cycle overcurrent curves for Type LRM current transformer.

Extends Line of Maintenance-free Epoxy-resin Units

Latest in a growing family of molded units, this Type LRM current transformer rated 5 kv is already a prime favorite with panel and switchgear designers. Molded of epoxy resin, this new transformer is virtually maintenance-free. It has high impact strength . . . resists mechanical forces, moisture and fire. These advantages at no extra cost.

All units are supplied with a short-circuiting strap, removable after installation. Base design permits mounting anywhere—on walls, bars, channels, etc.

Allis-Chalmers instrument transformers are available in the widest possible rating range. Many are molded units. Other epoxy-resin designs are in pilot production. For complete information, see your A-C representative, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

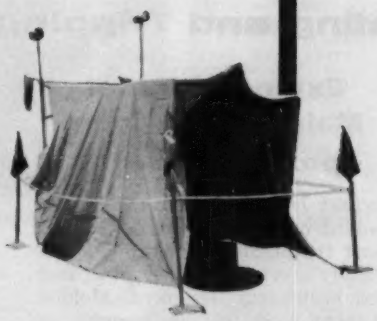
ALLIS-CHALMERS

A-5503

*. . . thinking about protective covering?**

When protective covering problems plague, CHAMPION tarps and covers are the solution. Less than half the weight of conventional covering, and more than twice as strong. CHAMPIONS are waterproof, mildew-proof, resistant to most chemicals, fire retardant.

* Con-Edison of New York had a protective covering problem. Needed were "Splicer's Sunshades" in distinctive Con-Edison orange. They had to be feather weight, yet tough enough to withstand rough handling. Here is the answer which you can see at anytime on the streets of New York.



PLASTIC CREATORS, Inc.

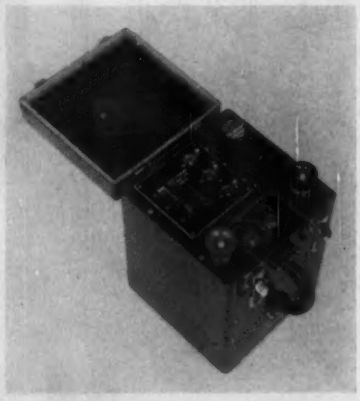
16 INDUSTRIAL AVE., LITTLE FERRY, N. J. • HU 9-9400

Motor Starters

(*Continued from page* 88)

or wound-rotor motors. Compact basic unit measures 34x32 in., and is completely front-accessible.

The starters are available with either air-break or oil-immersed contactors up to 1,500 hp at 2,300 v or 3,000 hp at 4,600 v. Current-limiting fuses provide short-circuit protection of 150 Mva at 2,300 v. and 250 Mva at 4,160 or 4,600 v. **Allis-Chalmers Mfg Co, Milwaukee 1, Wis.**



Testing Unit . . .

. . . for dc watthour meters is light and compact, has 50-amp capacity. Special features include:

1. Sealed cell requiring minimum maintenance, no replenishment of water or electrolyte. No gassing during charge or discharge.
2. Good discharge voltage characteristics. Load does not drop off during test.
3. Precise, easy control of load.
4. Approximate weight: 18 lb. Overall dimensions of metal case: 11x7½x7½ in.

Associated Lighting Service, Inc, 48 Moonachie Rd, Hackensack, N. J.

Three Recorders . . .

. . . are offered in compact cases. Circular chart potentiometer recorder, model 6801, has unitized construction for flexibility and ease

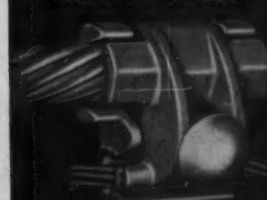
(*Continued on page* 94)

Connect
COPPER with COPPER
ALUMINUM with ALUMINUM
use...

PAC-5
ACSR 6—1/0 Cu. 8—1/0

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2



PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4 / 6—1 0 A R Cu. 8—1 0

BLACKBURN COPPER TO ALUMINUM FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORPORATION

1525 WOODSON RD. • ST. LOUIS 14, MO. • PHONE: WYdown 3-9430

Westinghouse
KILOWATT HOURS
TYPE D5
15 AMPS
SINGLE PHASE
INTERVAL
RECORDER NUMBER

Helping the industry meet its growing loads

"Red tape" that saves you money

It is magnetic recording tape employed in a Westinghouse load survey recording meter.

The recorder is a development resulting from a need of Electric Utility management for a recording unit which is accurate, inexpensive and less demanding of man-hours.

The recorder utilizes both recording tracks of the standard tape at the same time. One side records time intervals, and the other records demand impulses—up to 240 per interval. The recorder may be used in conjunction with standard A-base or socket-type meters. Operation speed is such that the recorder will complete a full 32-day cycle on a single 600-foot reel of tape.

A translator has also been developed for "playback" of the recorded tape—through an IBM 526 Printing Summary Punch. A full reel may be translated—and the information put on permanent record IBM cards—in 35 minutes or less —without the requirement of engineer-interpreters, card-punch machine operators and the like.

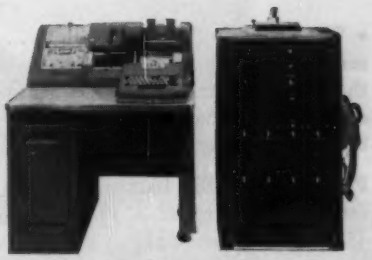
Information is so applied to the cards that practically any combination of load facts may be made quickly through application of an IBM card sorter.

In short, this is automation applied to your ever-present problem of determining load growth and load shift—and planning and adjusting your generation and distribution to match it efficiently and profitably. J-97209

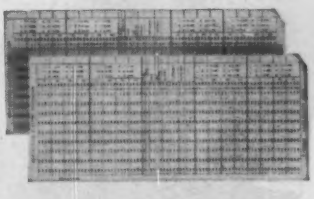
YOU CAN BE SURE...IF IT'S

Westinghouse

The Recording Mechanism. Accommodates standard 5" tape supply and rewind reels. Powered by 240-volt synchronous motor, operating at 2.35 inches per 15-minute interval. Recorder units interchangeable—simply "plug in" through bottom of meter-recorder case.



The Translator. Tapes are processed at 3¾" per second on 15-minute interval recordings, 7½ inches per second on 30-minute interval surveys. Processing of 600-foot tape on 15-minute interval requires 35 minutes—18 minutes for 30-minute interval recordings. Interconnects with IBM 526 Printing Summary Punch machine.

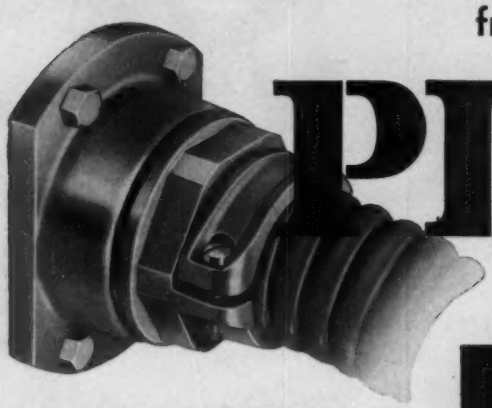


Permanent Record Delivered on IBM Cards. Cards provide for 80 columns of information and 12 positions in each column—plus customer and survey information, date and day of survey. On 15-minute interval surveys of 30-day duration, a total of 2880 demand readings are recorded, trans-speed of printing card punch. No interpreters required.

in a FIX for FITTINGS?

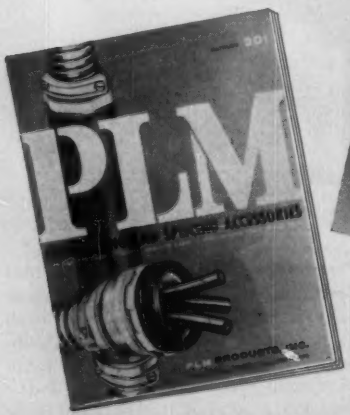
standards or specials . . . get them faster from

PLM



• Wet locations . . . dry locations . . . for terminations with potheads or without them . . . whatever your needs for armored cable terminating fittings or splices may be, you'll find answers, *fast*, from PLM.

PLM Catalog 301 lists and illustrates fittings for all types of installations to 15 kv, to meet standard as well as special requirements. Listed also are PLM Splicing and Terminating Kits to speed up the job . . . insure complete, correct materials for every armored cable splice and termination, as well as for splices in non-metallic and lead-covered cable. Ask for your copy.



NEW PLM CATALOG 301 includes dimensions and shipping weights, as well as prices, for planning cable installations. Fittings are listed in both cast aluminum and bronze.

PLM PRODUCTS, INC. · 3875 West 150th Street · Cleveland 11, Ohio
WIRE AND CABLE FITTINGS AND ACCESSORIES

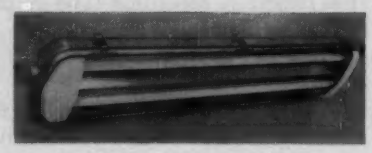
Three Recorders

(*Continued from page* 90)

of maintenance. A 12-in. circular chart with straight time coordinates increases readability.

Small case multipoint, model 6702, offers up to 12 points on a full size strip chart. Like the circular chart recorder, its unitized construction simplifies chart speed and range change.

Four-pen mechanical recorder, model 7812, has new case design. Systems measuring temperature from —200F to 1,000F and pressure from —30 in. vacuum to 7,500 psig are available as standard. **Weston Electrical Instrument Corp, Newark, N. J.**



Fluorescent Floodlights . . .

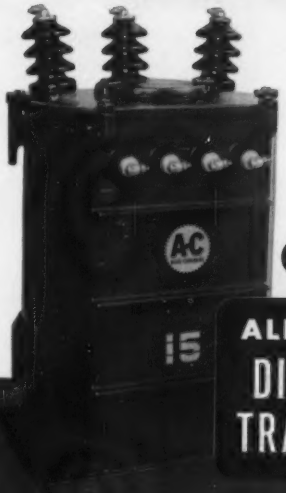
. . . for substations and other applications such as airport ramps, docks, or tunnels come in 4- or 6-ft lengths. They are designed to use either present standard or future higher-output lamps. Installation and servicing of the luminaires is eased by the combination latches, which permit opening the cover from either side with the opposite latches acting as hinges. Lamps remain in holders when reflector is open for access to internal wiring and ballast.

Tin-plated terminals take copper or aluminum conductors.
Line Material Industries, Milwaukee 1, Wis.

Current Limiting Fuses . . .

. . . have slotted tangs. This universal mounting facility enables fuse to fit proposed NEMA standard drilling or "Pringle" drilling, eliminating duplicate stocking.

Slotted-tang fuses are available for the 800 to 4,000-amp portion of the CLF line.
General Electric Co, Schenectady 5, N. Y.



New Three-Phase
Curvacore Transformer

CUTS Changeout COSTS

ALLIS-CHALMERS
DISTRIBUTION
TRANSFORMERS

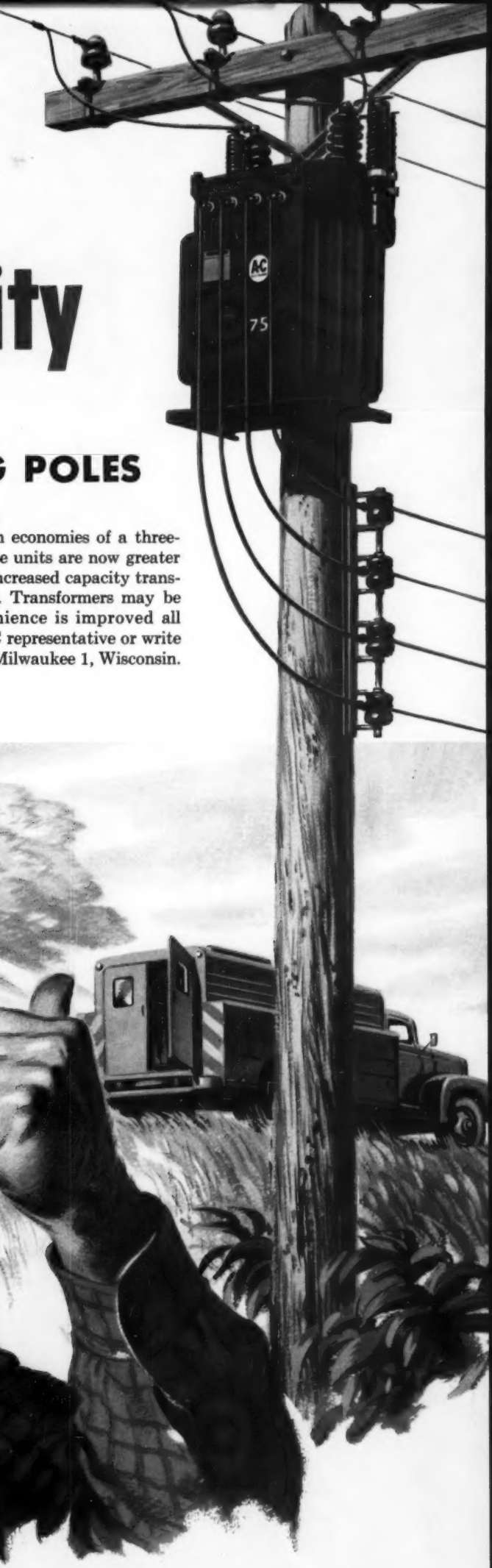
ALLIS-CHALMERS

Greater
Capacit

...ON EXISTING

THE size, weight and resulting installation ec
phase transformer over three single-phase un
than ever. Existing poles can be utilized for increa
formers. Costly installation time is reduced. Tra
mounted directly to pole. Handling convenienc
around. Get the complete story. See your A-C rep
Allis-Chalmers, Power Equipment Division, Milwa

ALLIS-CHA



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G POLES

n economies of a three-
e units are now greater
ncreased capacity trans-
. Transformers may be
nience is improved all
representative or write
Milwaukee 1, Wisconsin.

ALMERS

Greater Capacity ON EXISTING POLES

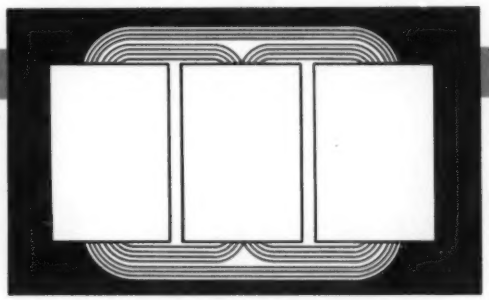
Average 13" Height Reduction

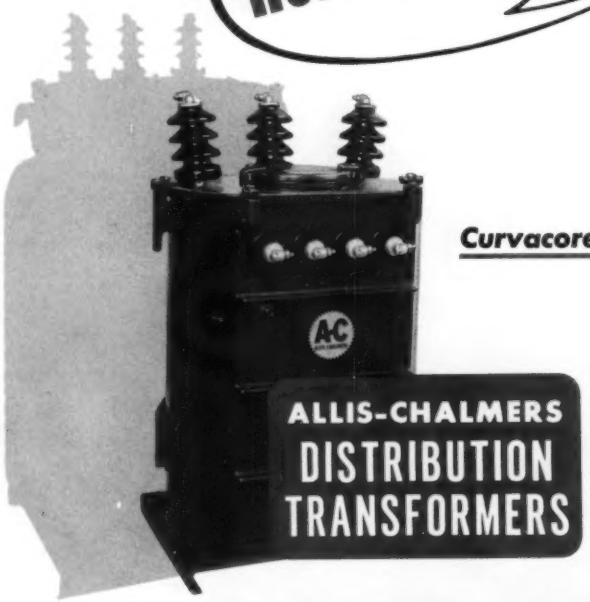
Average 25% Weight Reduction

HEIGHT and WEIGHT
Wound Core 3-phase Transformers
HIGH VOLTAGE — 12 kv through 14.4 kv delta
LOW VOLTAGE — 208Y/120 or 240 delta

KVA	OVERALL HEIGHT		WEIGHT	
	NEW	OLD	NEW	OLD
15	41½	50	610	665
30	44½	62	850	1120
45	51½	63	1115	1300
75	53½	68	1455	1920
112½	59½	70	1930	2565
150	65½	78	2285	3460

Here's Why





Curvacore Design Makes the Difference

A new wound core design, permitting the maximum use of preferred oriented steel, results in a compact core with low losses and low exciting current. Transformer height and weight are reduced considerably.

For complete information, see your A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

Curvacore is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5383

ELECTRICAL BUSINESS OUTLOOK

Electrical World
SEPTEMBER 30, 1957

1958 is shaping up as another year of "rolling readjustment"—with perhaps a little more readjustment than in past years. But don't put any stock in the rumors that we're in for a painful recession. Business will remain very good even if a little of the zip does go out of the boom.

And utilities are in for a record year no matter what happens. Of course, the size of the record depends on production rates in the major users of electric power. Here's how the big five—chemicals, paper, textiles, food, and primary metals—see their prospects for next year. (As a group, these industries consume about 60% of total industrial power.)

The chemical industry looks for production slightly above its high '57 level. Part of this optimism is pegged to expected improvements in textiles and paper. An Olin Mathieson spokesman placed inventories "at an abnormally low level," and expected 1958 sales to rise 5%.

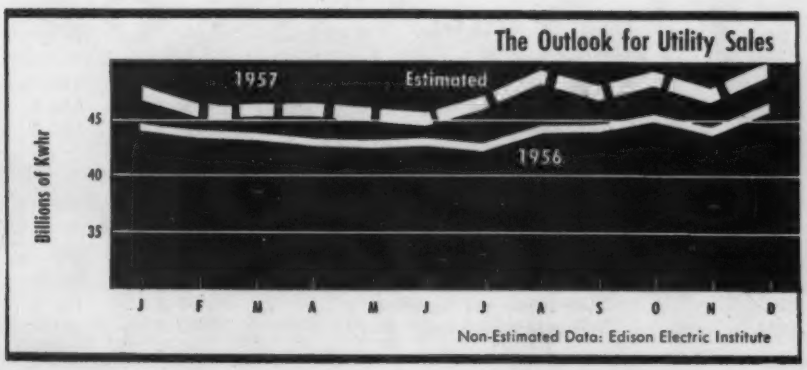
Paper should also show a slight rise in '58. The current downward adjustment has reduced production of paper and board by about 6%, but demand is expected to strengthen next year, and inventories should be back in balance in time to increase total production over 1957.

Textile production should go up. Wool is in a slump now with no immediate prospect of improvement, but business in man-made fabrics is beginning to hum, with low inventories and a healthy backlog of orders. Cotton mills, too, are planning to spin a little faster in '58. On the whole, said a Du Pont spokesman, the textile business should expand 2-5%.

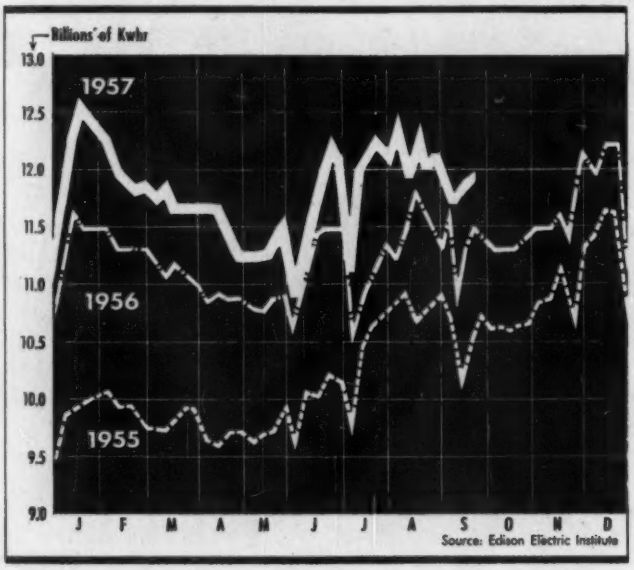
Food producers' outlook is briefly this: More people to feed. More money in their hands. QED: food production should rise 6-8% if crops are good.

The non-ferrous metals have an outlook ranging from questionable to poor. Domestic copper, lead, and zinc industries have already cut production drastically, and can only look forward to more of the same. Although aluminum looks for a bright future and new uses keep cropping up, current production is off and may stay at a lower level well into next year.

As for steel, which alone accounts for close to 20% of industry's kwhrs, production could go either up or down a bit in 1958. Which way depends largely on how consumers like the '58 model cars.



STATISTICS



OUTPUT

Week ended Sept. 21,
11,991,000,000 Kwhr
Up 4.4%

Per Cent Change From Previous Year

	Sept. 7	Sept. 14	Sept. 21
Total U. S.	+ 6.6	+5.4	+4.4
New Eng.	+ 5.8	+6.0	+6.3
Mid. Atlan.	+ 2.9	+7.1	+7.9
Cent. Ind.	+ 4.2	+2.1	+2.9
West Cent.	+ 8.4	+3.0	+2.5
Southeast	+ 7.7	+7.1	+5.7
South Cent.	+16.1	+6.5	+0.5
Rocky Mount.	+ 2.1	+3.8	+2.4
Pacific			
NW	+ 8.1	+8.6	+4.3
SW	+ 7.6	+8.6	+5.7

Seasonally Adjusted Index 229.8
Week Ago 229.0
Year Ago 219.0

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 5.6%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	July	124.99	124.43	117.54	6.3
Peak—Class 1 Systems. } million kw	May	97.8	97.7	92.8	5.4
Estimated Dec. '57 Peak	June	113.6	113.6	114.4	−0.7
Production—billion kwhr	July	54.35	52.05	49.45	9.9
Hydro		10.81	11.18	9.91	9.1
Fuel		43.54	40.87	39.54	10.1
Sales—billion kwhr	June	46.99	46.60	44.46	5.7
Residential		11.91	11.86	11.02	8.1
Commercial		7.90	7.38	7.29	8.4
Industrial		24.64	24.89	23.72	3.9
Other		2.54	2.48	2.42	5.0
Fuel Consumption	July				
Coal—million tons		12.72	12.50	12.00	6.0
Oil—million barrels		5.51	6.24	4.32	27.5
Gas—billion cu ft		158.91	125.72	136.97	16.0
Net Income Class A & B Co's $—million	June	109.69	101.75	101.54	8.0
Residential Customers—millions	12 mos.	46.26	46.16	44.99	2.8
Revenue per kwhr	ended	2.58¢	2.58¢	2.62¢	−1.5
Avg kwhr per customer	June 30	3,063	3,047	2,879	6.4
Avg annual bill		$79.03	$78.61	$75.43	4.8

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	July	144	135	142	1.4
ENR Construction Cost	Sept.	154.7	154.8	147.8	4.7
BLS Cost-of-living	July	120.8	120.2	117.0	3.2
New Orders for Machinery (1950 = 100)	July	146	153	146	n.c.
NEMA Sales					
Insulation materials	July	127	140	117	8.5
Electric appliances		101	93	111	−9.0
Wholesale prices	June				
Motors and generators		141.0	141.3	132.3	6.6
Transformers and regulators		147.8	147.7	138.2	6.9
Switchgear and fuses		166.0	165.9	152.3	9.0
GNP—annual rate—$ billion	2nd qtr.	434.4	429.1	410.8	5.7

MANAGEMENT BULLETIN

FINANCE

A better tone has developed in the new offering market. This happened shortly after the Eastman, Dillon, Union Securities Corp group sold quickly $20 million first mtg 5¾% bonds of Pacific Power & Light Co at 100.714% to yield 5.70%. These bonds carried "Baa" rating by Moody's and "A" rating by two other services.

Earlier the underwriters had a good block of the $200 million debenture and bond issues on their shelves for sale to the public. They carried "Aa" and "Aaa" ratings with yields running from 4.625% to 4.86%. These bonds should begin to move after the successful completion of the Pacific P&L issue.

The 1957 construction program of electric companies, amounting to $3.8 billion, looks now as if it will be financed by the sale of $2.6 billion in securities, around $850 million from depreciation, and $350 million from earnings and bank loans.

Heavy security offerings are being scheduled for the next two months by the utility industry. However, December is "quite light" at the moment. This was revealed by John Childs, vice president, Irving Trust, in the "Looking Ahead" bulletin just released.

A total of $300 million new electric and gas issues is slated for October. In addition, American Telephone & Telegraph is selling $250 million debentures and Southwestern Bell Telephone Co, $100 million debentures. November, says the bulletin, has a normal number of new issues.

Electric utilities have sold $1.9 billion to date. If planned financings are completed, they will sell $2.6 billion for 1957. This is 82% more new money financing than 1956, the bulletin concluded.

REGULATION

Customers of all public utilities in Indiana face a costly raid on their pocketbooks if the Public Service Commission does not repudiate a rate-fixing policy of its former members, says PSC's Public Counsellor George L. Diven.

Diven's statement opened his campaign against an "economic depreciation basis" under which former PSC members granted the Indiana Telephone Corp a $744,000 annual rate boost last Jan. 11, only a few hours before their terms ended.

By going along with ratepayers' pleas for reopening the case, the present commission displayed at least some dislike for its predecessor's deviation from traditional rate-making basis, Diven said.

He added, however, that he intended to "go all out" in behalf of reconsideration of the company's rate petition under the long-accepted "actual investment, depreciated" method. "If the precedent set by the previous commission isn't repudiated," Diven declared, "we'll be stormed by utilities seeking big rate increases under the fallacious policy it adopted in its waning hours." **Hearings** are scheduled for Sept. 30 in Indianapolis.

RATES

Electric companies continue to ask for rate increases. Plymouth County Electric Co is asking the Massachusetts Department of Public Utilities approval to up rates by $251,500 a year. Southern Nevada Power Co is requesting an estimated $1,060,000 a year, or 13.8%. Company hopes to put the new rates in effect by March 1, 1958, at the end of the winter heating season.

Bowling Green, Ohio, Electric Department has announced an average rate reduction of 10% to all consumers. Superintendent D. T. McKnight said the

reduction was made possible because of a new contract with Toledo Edison Co that went into effect last March.

Ordinances providing increases in rates for the city's municipal utility have been signed by Los Angeles Mayor Norris Poulson "with reluctance." Approved previously by the City Council, the ordinances contain escalator clauses giving the Los Angeles Water and Power Commission authority to raise or lower rates whenever the price of fuel for steam generation affects the base rate of three mills per kwhr.

TAXES

Twenty states have increased the rates of one or more of the taxes levied by them, the "Wall Street Journal" reported recently. At least five of these states increased the rate of their corporate income taxes and a number of others upped rates of other types of taxes which would be applicable to the electric utility industry.

This tends to increase unnecessarily the burden on the customers of electric utilities, assuming of course that such additional costs can be passed on. In many instances because of regulatory lag, the utilities would be the ones who would underwrite this expense.

It would appear that higher taxes produced by greater business activity, resulting in higher personal and corporate income taxes, should be sufficient to meet these higher expenditures. In increasing the tax rates, states are creating additional inflation.

However, the real crux of the problem lies in the fact that the federal government has taken over the taxing power of the states. It should be returned to the states if an effective job of raising revenues at the "grass roots" level is to be done.

EMPLOYEE RELATIONS

Seattle Dept of Lighting employees will get increases ranging from $5 to $167 a month under the 1958 budget. Largest increase, $167, goes to the assistant city engineer, raising his salary to $12,000 a year. Electrical workers are slated for increases ranging from $16 a month to $23. Linemen's pay goes up from $23.60 a day to $24.56. Clerks will get $5 and $10 more a month.

ACQUISITIONS

Northern States Power Co of Wisconsin is buying Wisconsin Hydro Electric Co's electric and gas systems serving 10,000 electric urban and 3,700 rural customers. The purchase, to be made through an exchange of stock, is a $6-million transaction. Actual property transfer is expected in December.

Ohio Power Co has bought Celeryville Mutual Light & Power's lines, transformers, and poles for $64,000.

AREA DEVELOPMENT

The newly-formed Home Improvement Council will kick off its 1958 promotion with a $250,000 contest aimed at stimulating the American home-owner to fix up his house. Entrants must first describe their "No. 1 Home Improvement Project" in 25 words or less, then go on and do what they have described. The $25,000 first prize is expected to lure several hundred thousand entries—"Better Homes and Gardens" will bind 4½ million entry blanks in its January issue.

SELLING

"Will You Heat With Electricity" is an article that is appearing in Reader's Digest" for October.

Night view, showing the "Leisure House," customer-service building, center of Tampa Electric's active "Live Better Electrically" program. The simplicity of HAPCO's Venetian Column design blends with the modern architecture and maintains a feeling of spaciousness in the well planned parking area.

For Tampa Electric Company...

Trim, modern appearance of HAPCO Poles and Brackets complements "Live Better Electrically" program

By day, the spacious parking area at Tampa Electric Company accommodates office employees and visitors. At night, mercury vapor lamps mounted on HAPCO Poles and Brackets light the way for customer meetings and demonstrations at the "Leisure House." Here, through scheduled demonstrations by trained Home Economists, supplemented by displays of the latest electrical appliances, lighting and air conditioning, Tampa residents truly learn how to "Live Better Electrically."

Although atmospheric corrosion is a major problem in coastal or industrial areas, long service life can be expected from the 24 HAPCO Poles and Brackets here, since both are made from corrosion resistant aluminum. After being "spun" from aluminum alloy, HAPCO Poles and Brackets undergo special heat treating for maximum structural strength. Aluminum's attractive silver grey finish requires no initial or maintenance painting, and lightness in weight means additional savings in transportation and erection costs.

In the complete HAPCO line of Standards and Brackets are designs for all types of outdoor lighting installations. For more information, write to Hubbard Aluminum Products Company, 6301 Butler Street, Pittsburgh 1, Pennsylvania.

LIVE BETTER ELECTRICALLY

Tampa Electric's new headquarters are located on Dale Mabry Highway, midway between the northern city limits and Gandy Boulevard. At night, this heavily travelled, seven mile section of U.S. Route 92 comes brilliantly alive with light from 259 mercury vapor luminaires mounted on 208 HAPCO 8-foot Brackets and 51 HAPCO 6-foot Brackets.

HUBBARD ALUMINUM PRODUCTS COMPANY
Division of Hubbard and Company
Pittsburgh 1, Pennsylvania

GE Axial Exhaust Improves Turbine Efficiency

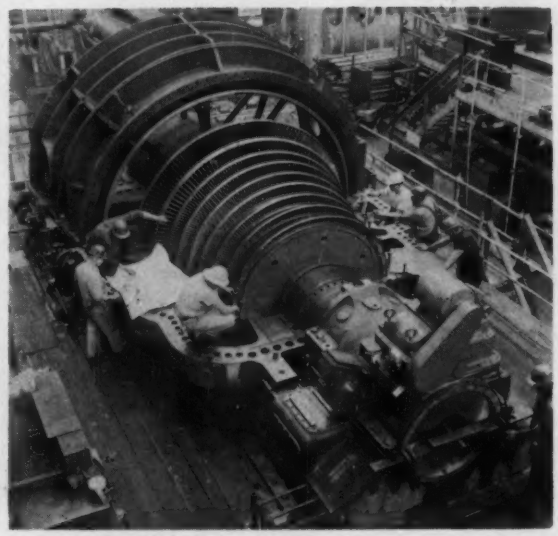
Lower construction costs are also cited as advantage in 125-Mw unit for SCG & E

An important improvement in steam turbine design is the exhausting of the steam horizontally along the axis of the turbine shaft and into the condenser which is attached to the exhaust end of the turbine. Usual arrangement in today's design is to exhaust the steam downward into the condenser located directly below the exhaust end of the turbine.

The improvement is incorporated in a 125-Mw turbine-generator being built by General Electric Co at Schenectady, N. Y. It is being built for South Carolina Gas & Electric Co and is scheduled for shipment late this year. A portion of the unit embodying the improvement is shown being assembled.

The new feature is described as "axial flow exhaust" and has two important advantages. First, it improves the efficiency of the turbine—requiring less fuel, coal or gas to operate, which may amount to a fuel saving equivalent to 2000 tons of coal in a year's operation. Second advantage is a saving in the cost of the station, because the condenser is located at the same level as the turbine instead of beneath it. Thus turbine foundation and turbine room structure can be lower, resulting in lower construction costs.

This generating unit is the first of two similar machines in a new station to be located on Lake Murray



and near the utility's Saluda Dam hydro station.

The turbine is a cross-compound, single-flow reheat type with axial flow exhaust. Steam enters at 2400 psig and 1050 F. High-pressure element operates at 3600 rpm, and low-pressure element at 1800 rpm.

Cooling water for the condenser will be about 55 F during the year, will come from the penstocks of the hydroelectric station, which takes water from the bottom of Lake Murray.

Federal Pacific Redesigns AB Breakers

A series of improved molded case AB circuit breakers are under development by Federal Pacific Electric Co, Newark, N. J., advises C. A. Schmidt, industrial products department manager of the company.

The redesigned line of breakers are reported to provide increased electrical ratings, smaller physical sizes, and lower unit costs for industrial breaker users.

Two breakers are expected to be ready for the market in a few weeks. They are:

1. A three-pole, 480-v breaker believed to be the first breaker designed specifically for 480-v industrial service. This type NEF has ratings from 15 to 100 amp a-c.

2. A single-pole, 120-v breaker designed specifically to double the number of lighting circuits without increasing the overall size of panel boards. The type NEW is in a 11/16-in. thick case and has ratings of 15 and 20 amp.

U. S. Aluminum Production

Primary aluminum production in U. S. totalled 143,448 tons for August, according to the Aluminum Association, New York. The amount is a 1,290-ton increase over July. Total production for the year through August was 1,110,733 tons, an increase of 6,407 tons over the 1,104,326 tons for the corresponding 1956 period.

Delta-Star MK-40 Switch Expanded to 380 Kv

The Delta-Star 345-kv MK-40 vertical break switch design has been expanded to 380-kv. Delta-Star Electric Division of H. K. Porter Co Inc, was informed of this expansion by its French manufacturer in Paris.

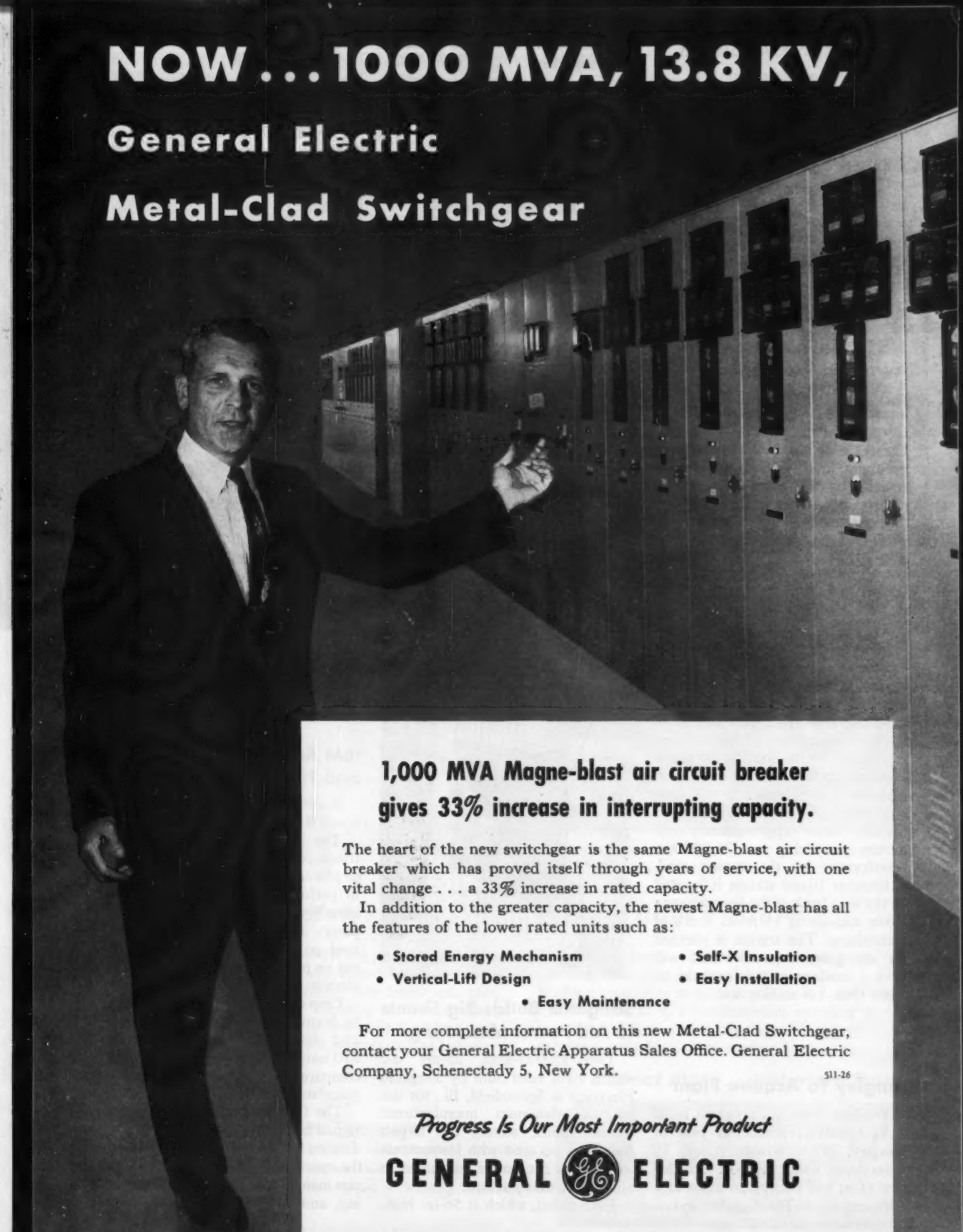
French post type insulators are used together with horizontal corona rings atop the insulator stacks. The 345-kv torsional counter-balance

(*Continued on page* 106)

NOW . . . 1000 MVA, 13.8 KV,

General Electric

Metal-Clad Switchgear



1,000 MVA Magne-blast air circuit breaker gives 33% increase in interrupting capacity.

The heart of the new switchgear is the same Magne-blast air circuit breaker which has proved itself through years of service, with one vital change . . . a 33% increase in rated capacity.

In addition to the greater capacity, the newest Magne-blast has all the features of the lower rated units such as:

- **Stored Energy Mechanism**
- **Vertical-Lift Design**
- **Self-X Insulation**
- **Easy Installation**
- **Easy Maintenance**

For more complete information on this new Metal-Clad Switchgear, contact your General Electric Apparatus Sales Office. General Electric Company, Schenectady 5, New York.

511-26

Progress Is Our Most Important Product

GENERAL ELECTRIC

Delta Star MK-40 Switch

(*Continued from page* 104)

springs are inside apparently cast housings. Variations in design for reasons of economy have been noted.

Further details are being obtained by Delta Star to cooperate with the French manufacturer and still maintain as many advantages of the American design features as possible in the building of future switches.

A $12 Million Contract Awarded Westinghouse

A $12 million contract has been awarded to Westinghouse Electric Corp by Pennsylvania Power & Light Co for a 300-Mw turbine-generator and related equipment. Installation will be made in Brunner Island steam electric station, the currently largest generating plant to be constructed by the utility.

This 3600-rpm cross-compound steam turbine is scheduled for delivery in the autumn of 1959. Included with the generating equipment is a two-pass surface condenser capable of handling steam at the rate of 1,440,000 lb per hr. This is one of the largest condensers Westinghouse has built.

Other equipment to be supplied by Westinghouse consists of transformers, power circuit breakers, metal-clad switchgear, control centers, relays, low-pressure feedwater heaters, and approximately 60 motors requiring a 25,000-kva transformer for the station load.

Brunner Island station is located on the west bank of the Susquehanna River and about 15 miles south of Harrisburg. This station is planned for six generating units and will have a total generating capacity of more than 1.8 million kw.

Langley To Acquire Plant

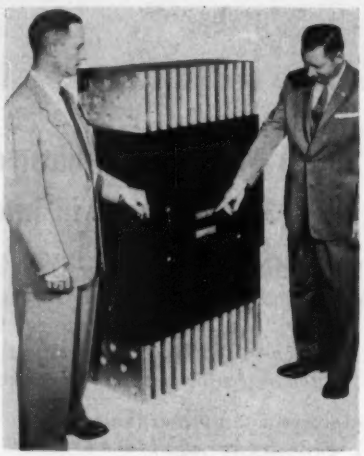
Western Wire & Cable will build a $1.5 million plant this year at Langley, in the Fraser valley, 30 miles from Vancouver, B. C. This new plant will occupy 26 acres of a 100-acre tract. The Langley industrial site is being developed by Langdell Properties Ltd., a group of British Columbia investors headed by J. E. Termeunde, president of Western Wire & Cable.

Allis-Chalmers Forms International Division

Allis-Chalmers International has been formed as a major operating division of Allis-Chalmers Manufacturing Co, advises R. S. Stevenson, president of the firm.

P. F. Bauer, general manager, Industrial Equipment division, has been named managing director of the new division. Paul Dietz and Floyd J. Mischke were named associate directors of sales of Allis-Chalmers International.

This new division will be responsible for all manufacturing, engineering and sales operations and activities outside of the United States and Canada. Manufacturing operations include plants in Essendine, England, and in New Castle, Australia.



Sangamo Builds Big Shunts to Aid Power Measuring

Two 85,000-amp, 25-mv d-c shunts have been built by Sangamo Electric Co, Springfield, Ill., for use by an aluminum manufacturer. These shunts, among the largest built, will be used with instruments to measure the power consumed in aluminum manufacture.

Each shunt, which is 56-in. high, 34-in. long, and 15-in. deep, consists of three main parts: manganin blades which constitute most of the shunt resistance; tangs made of copper bars arranged to accommodate the unit to the customer's direct bus system; and endblocks, made from a 5.5 ton copper billet 70-in. square and 15-in. thick, to hold the ends together.

Inspecting one of the shunts are Kieth Bowers, sales manager, d-c equipment, and Charles R. Schultz, Jr., project engineer.

Synchronous Motors Drive Memphis Condenser Pumps

Six vertical synchronous motors, rated at 1,250 hp, to drive condenser pumps will be supplied by Electric Machinery Mfg Co, Minneapolis, for Light, Gas & Water Division, City of Memphis, Tenn.

These motors are to be operated at 360 rpm and an efficiency of 95.3%. This is one of the first uses of synchronous motors of this size in as critical a spot as condenser pump drives in a power plant. Reasons for the choice of these motors included their low initial cost as well as their high efficiency.

IBM Auto-Point Computer and Time Punch Unveiled

Recent developments by International Business Machines Corp, are:

The IBM 610 auto-point electronic computer is small enough to be placed aside a desk. It is designed to perform some of the tasks previously fed to larger electronic computers, and provides automatic decimal point control. Results can be put on punched tape or a high-speed electric typewriter.

Operation of the computer can be learned in about an hour. In a trial design of a transformer, the 610 unit performed in about 15 min compared to an engineer with a desk calculator requiring about 6 hr.

The IBM 8200 time punch is designed to punch payroll and job cost data on IBM cards at the source of the operations. This machine eliminates manual computation, key punching, and verification.

Contact speed and burning are directly related — excessive burning of contacts will occur with either too slow or *too rapid* contact break. The former delays arc extinction, the latter frequently causes flashover between stationary contacts. Exclusive Westinghouse direct-drive Geneva gear mechanism consistently assures optimum speed. Result . . . arc extinction at first current zero — no flashover, minimum burning.
Westinghouse announces
20-year contact life warranty
For URS tap-changing mechanism . . . regardless of number of operations
Field inspections of scores of URS tap-changing mechanisms, in service 8 years or more, show negligible contact wear and burning. Based on this proved performance, Westinghouse now offers a 20-year prorated warranty on contact life — *regardless of number of operations!*
Load tap changers are direct
action assures optimum
prevent burning.
is not

This Customer's Ad Tells the Mallory Story . . .

Mallory Elkonite®-3W3, a superior grade contact alloy especially suited for heavy duty service, helped make this important plus-service possible. Elkonite is one of many contact materials pioneered by Mallory for the electrical equipment manufacturing industry.

For contact metals, or for contact design, do as many manufacturers have done—call on Mallory, specialists in contact metallurgy, for *complete* assistance, from materials selection to contact design and production. Write, or call the nearby Mallory representative.

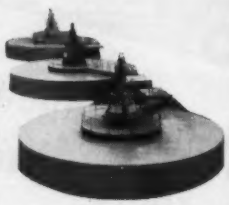
Expect more...get more from

Serving Industry with These Products:

Electromechanical — Resistors • Switches • Tuning Devices • Vibrators
Electrochemical — Capacitors • Mercury and Zinc-Carbon Batteries
Metallurgical — Contacts • Special Metals • Welding Materials

P.R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

100,000 Kw. under control . . . NELSON CONTROL . . . at Gavins Point Dam



This control room, equipped with Nelson instrument panels, control panels and consoles is the nerve center of Gavins Point Dam, South Dakota, which generates 100,000 kilowatts of electricity.

At Nelson Electric Manufacturing Company, engineering know-how and manufacturing skill are combined in producing instrument panels, control panels and graphic panel boards that meet, in every detail, the specifications of each customer.

When quality is important, specify NELSON for the best in electrical control equipment.

a major source of electrical control equipment for industry

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

Switches Bus Mounted

(*Continued from page 59*)

calculated at 0.6 in. without ice loading and 0.9 in. with ½-in. ice. As initial deflection takes place at installation, only deflection caused by ice loading must be considered. To provide for this variable deflection, the switch jaw contacts and latching device were designed to accommodate a ±1 in. variation lengthwise along the blade. The jaw contact bolted to the adapter is adjustable lengthwise with the blade for proper alignment at installation.

General features of the design include use of aluminum cable and compression fittings. Main transformer span and circuit conductor within the substation is 1,113-MCM ACSR; bolted-type connectors and fittings are used on aluminum buses. Complete overhead ground wire protection is provided in station and on circuit and transformer spans. Column spacing was increased from 22 to 30 ft.

All disconnect switches are hookstick operated except the transformer span and autotransformer switches. These exceptions are gang operated manually and equipped with switches for grounding span and transformer. Lighting arresters are installed only on each main bus. All control is from the power plant control room where relays are situated.

Conduit Is Plastic

For a duct bank for control and auxiliary station power from the power plant to manholes in the substation yard there are 30-ft lengths of 2-in. plastic conduit encased in concrete. Plastic conduit is less costly than asbestos-cement conduit and may be installed in about a third of the time. Buried steel conduit is used from carefully placed manholes to the equipment. All duct banks are straight runs from manhole to manhole.

The yard surface is paved with asphalt for convenience of operating personnel and ease of maintenance. Use of duct banks and conduit obviate costly removal and replacement of pavement for additions and changes. The asphalt is treated with a flame and oilproof coating, and a liberal surface-drainage system is provided.

NEW TWO-STATOR NETWORK METER

New economies with Sangamo Type P2S for your fast growing polyphase loads

APPLICABLE TO SMALL LOADS AND LARGE ONES. Range extended in both directions permits meter to start at ¼% of rated load yet operate continuously at 666⅔% of rated load with a maximum temperature rise of 50° C. Gives economies through increased range of application.

APPLICABLE TO SERVICE OF MANY VOLTAGES. Accurate registration without special calibration is provided for circuit variations from 42% to 125% of rated voltage. A single meter, the 240 volt P2, may be used on 120/208, 240/416 and 277/480 network systems, and also on 3 wire 3 phase and 3 wire single-phase circuits. Gives economies through reduced stocks.

TIME SAVED IN ADJUSTMENTS. Only four adjustment points—full load, light load, balance, and power factor—reduce testing and calibration time.

SAVINGS IN HEIGHT AND COVER REPLACEMENT. The Sangamo P2S Meter has been substantially reduced in height. The cover is the same as that used on all singlephase metal base socket meters manufactured since 1936.

PROVEN ECONOMY THROUGH SLOW SPEED. Sangamo *slow speed*—proved so successfully on the singlephase Type J2 Sangamo Meter—gives even greater benefits in two-stator meters. Reduced series damping and fewer revolutions just naturally mean greater accuracy and better performance.

Sangamo Type P Meters will be available for measurement of all types of polyphase service.

SANGAMO *Electric Company*
SPRINGFIELD, ILLINOIS

IF IT CARRIES CURRENT,
K/W CARRIES IT!

To begin the test for ozone resistance, these six samples of competitive neoprene jackets were stretched 200% of original length and put in a test chamber with ozone held at .025% to .030% volume.

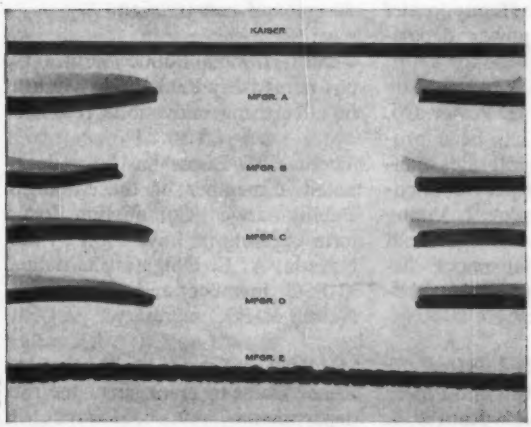
K&W POWER CABLE—PROVED THE MOST RUGGED

IN THE BUSINESS BY AN OZONE CHAMBER TEST OF POWER CABLE JACKET SAMPLES: WHILE JACKETS FROM THE FIVE LEADING COMPETITORS FAILED IN TWO AND ONE-HALF HOURS OR LESS, K&W NEOPRENE JACKET WAS STILL GOING STRONG... FOR 18 HOURS! THAT'S OZONE RESISTANCE SEVEN TIMES AS GOOD AS THE NEXT BEST! FOR FULL FACTS ABOUT HIGH-VOLTAGE K&W POWER CABLE, CALL YOUR K&W DISTRIBUTOR OR CONTACT THE NEAREST SALES OFFICE OF...

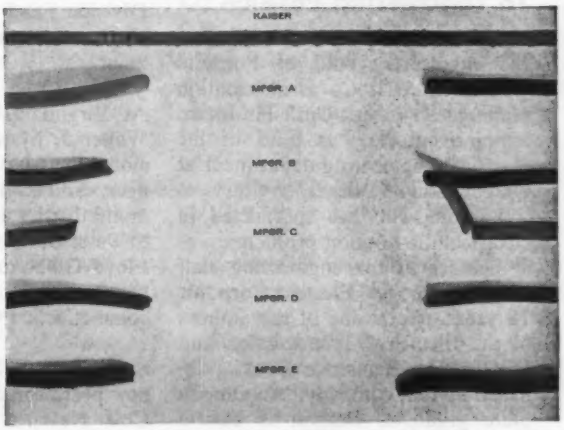
KAISER Aluminum

LIVE BETTER ELECTRICALLY

Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, California; *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois.



Two hours and 23 minutes after the start of the test, Brand E is disintegrating. Brand B failed 13 minutes earlier, and the other brands failed an hour or more before. The KW jacket shows no sign of damage.



After seven hours of the test, KW Power Cable's jacket is just beginning to show signs of minor damage. (Brand E failed after two hours and 30 minutes.) The KW jacket did not fail until after 18 hours of exposure!

PSE&G Advances Freer

Frank Freer, Jr., has been appointed as comptroller of Public Service Electric & Gas Co. In his new capacity he replaces F. Warren Cooper, who has retired.

Freer, who has been assistant comptroller since 1950, has been with the New Jersey utility for 37 years. After graduating from New York University, Freer joined the utility in 1920 as a bookkeeper. He remained in that position until 1935, when he was promoted to assistant chief accountant. He rose to chief accountant in 1945. Freer has been active in Edison Electric Institute committees and is a member of Controllers Institute of America and the Institute of Internal Auditors.

Lewis R. Fay, formerly chief accountant, has been named to succeed Freer as assistant comptroller.

FRANK FREER, JR

PGE Appoints Barnett To Engineering Position

Howard G. Barnett has joined the engineering staff of Portland General Electric Co as distribution planning engineer. Until his recent appointment he was head of the electrical engineering department at Oregon State College.

Barnett, who has specialized in electrical distribution problems, was a member of the engineering staff of Westinghouse Electric Corp for 18 years. He is one of the authors of the Electrical Transmission and Distribution Reference Book, published by that company. An Oregon State graduate, Barnett is also a fellow of the American Institute of Electrical Engineers.

Louis N. Stone replaces Barnett in the Oregon state post.

PERSONAL BRIEFS

Harry A. Schroth has been named Billings Division manager of Montana-Dakota Utilities Co to succeed **J. E. Moore** who retires Dec. 31. Schroth will continue to direct the pipe line and production department.

Paul Wagner was recently appointed purchasing agent for San Antonio's City Public Service Board. New superintendents are **Frank December,** for the Underground, Substation, and Metering Division; **Ollie Schneider**, Overhead Construction Division; and **Jesse Poston**, Operations Division. In addition, **James Millar** was named staff engineer; **A. C. Alberti**, head of the Industrial Division; and **Cecil Henny**, chief electrical engineer, power department.

At Virginia Electric & Power Co, **Walter J. Matthews** has been promoted to assistant general sales manager; **S. Harold Fletcher** to Richmond district manager; **A. J. Young** to Petersburg district manager; and **Floyd Gibbs** to Rappahannock district manager. All appointments become effective October 16.

S. H. Lebold has advanced to the new post of manager of Ohio Power Co's Newark district. **Robert I. Bull** becomes Southern Division commercial manager and **Lloyd B. Resler** system commercial sales supervisor.

Ray E. Harbaugh has been elevated to manager of Philadelphia Electric Co's Systems Division . . . United Gas Improvement Co's **George A. Batey** is now lighting engineer for Luzerne Electric Division.

Pennsylvania Power Co has named **George T. Roberts** general appliance sales supervisor and **Walter K. Conover** general supervisor of publicity and sales promotion.

At Los Angeles Dept of Water & Power, **A. L. Williams** has advanced to assistant chief electrical engineer; **E. L. Kanouse** to engineer of design and construction; and **O. L. Sidenfaden** to assistant engineer of design and construction.

Central Illinois Public Service Co has named **Jay Paul Wade** manager of advertising and public relations.

Thomas M. Burns has been designated a member of the Michigan Public Service Commission for a term expiring in July, 1963 . . . In Nevada, **A. E. Holgate** was named a PSC member and **Chester N. Newell** as PSC secretary.

Middle West Service Co has elevated **Elmer Gates** to manager of the rate department.

Harold R. Huntley has been named chief engineer of American Telephone & Telegraph Co, New York.

JOHN REINE

Graybar Elevates Reine to VP

The board of directors of Graybar Electric Co, Inc, has announced the recent election of John Reine as a vice president of the company. Reine, whose specific responsibilities will be announced at a later date, will join the headquarters staff in New York City on January 1, 1958.

Reine has served as central district manager and a director of the company since 1956. A 30-year Graybar employee, he started with the firm in 1927 as a warehouseman. In 1929 he advanced to assistant power apparatus specialist. His promotion to sales manager at Tacoma in 1932 was followed five years later by his appointment as manager of that branch. He was named Portland manager in 1949, Minneapolis district manager in 1951, Cincinnati district manager in 1953, and in 1955 was named assistant district manager at Chicago.

Dr. William L. Everitt has been named the second recipient of American Institute of Electrical Engineers' medal in Electrical Engineering Education. He is dean of the college of engineering, University of Illinois.

New president of Northwest Electric Light & Power Assn is **John T. Kimball**, vice president of Idaho Power Co.

Robert L. Grunewald was recently named manager of manufacturing for General Electric Co's gas turbine department.

Westinghouse Electric Corp has named **William S. Perkins** director of purchases for the general products group . . . Transformer Division has named **M. L. McCartney** works manager, distribution transformer department; **E. B. Lawrence** superintendent of operations of the same department; and **C. E. Hutchison** works manager of the new distribution transformer plant now being built in Athens, Ga.

Electric Storage Battery Co's Exide Industrial Division has appointed **William S. Buckley** as supervisor of plant engineering. . . **Raymond Schramm** has assumed new duties as chief project engineer for the Instrument Division of Thomas A. Edison Industries, McGraw-Edison Co.

John J. Flaherty has joined the Atomics Internation Division of North American Aviation, Inc, as general manager. He is former manager of the Chicago operations office of the AEC.

Allis-Chalmers Manufacturing Co has advanced **A. D. Foote** to assistant director of purchases. He succeeds **C. H. Norton**, retired.

Delbert L. Mills is newly named executive vice president of Federal Telephone & Radio Co, a division of International Telephone & Telegraph Corp. . . At Benjamin Electric Mfg. Co, **Benjamin S. Benson, Jr**, has been named director of engineering.

John L. Cotsworth is new staff manager of stainless steel for Chase Brass & Copper Co.

OBITUARY

Dr. Arthur H. Barnes, 53, director of Argonne National Laboratory's Reactor Engineering Division, died recently from a heart ailment.

Phillip C. Gifford, 65, president of Wolverine Power Co of Michigan, died recently in Providence, R. I.

Leo F. Ryan, 64, purchasing agent for Ohio Power for 27 years, died recently after a heart attack.

Brown is Elected VP Of United Engineers

Newly elected vice president and construction manager of United Engineers & Constructors, Inc, is Gerald H. Brown. In his new position he will supervise construction of two generating stations now being built by Public Service Electric & Gas Co at Linden and Bergen, N. J.

Brown has been in the engineering construction field for the past 35 years.

Most recently he supervised the construction on central power stations at St. Clair and River Rouge, Mich, for Detroit Edison Co. He also directed part of the construction of Power Reactor Development Co's Enrico Fermi nuclear power plant at Monroe, Mich.

MEETINGS CALENDAR

SEPTEMBER

Edison Electric Institute—Electrical Systems & Equipment Committee, Cosmopolitan Hotel, Denver, Colo., Sept. 30-Oct. 1.

OCTOBER

Pennsylvania Electric Association—50th Annual Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 2-3; Communications Committees, Abraham Lincoln Hotel, Reading, Pa., Oct. 7-8; Meter Committee, Shenango Inn, Sharon, Pa., Oct. 10-11; Relay Committee, Abraham Lincoln Hotel, Reading, Pa., Oct. 17-18; Systems Operations Committee, Bedford Springs Hotel, Bedford, Pa., Oct. 24-25; Transmission & Distribution Committees, Lord Baltimore Hotel, Baltimore, Md., Oct. 31-Nov. 1.

Indiana Electric Association—French Lick-Sheraton Hotel, French Lick, Ind., Oct. 2-4.

Missouri Valley Electric Association—Sales & Rural Conference, (and Home Service Workshop), Lassen Hotel, Wichita, Kansas, Oct. 2-4.

International Association of Electrical Leagues—Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, Oct. 2-5.

Northwest Public Power Association, Inc—Power Use Section Annual Meeting, Newport, Oregon, Oct. 3-4.

National Industrial Conference Board—Atomic Energy Course for Management, Hotel Moraine on the Lake, Highland Park, Ill., Oct. 6-12.

Edison Electric Institute—LBE Press Conference, New York City, Oct. 7; Mid-Atlantic Home Service Workshop, Philadelphia, Pa., Oct. 7-8; Prime Movers Committee, Hotel New Yorker, New York City, Oct. 7-9; Home Service Committee, Philadelphia, Pa., Oct. 9; Commercial Division Executive Committee, New York, N. Y., Oct. 9-10; Area Development Workshop, Phoenix Hotel, Lexington, Ky., Oct. 9-11; Transmission & Distribution Committee, Statler Hotel, Boston, Massachusetts, Oct. 17-18; Insurance Committee, Dearborn Inn, Dearborn, Mich., Oct. 17-18; Accounting Division Taxation Accounting Committee, held jointly with AGA, Williamsburg, Virginia, Oct. 23-25.

Iowa Utilities Association—Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, Oct. 7-8.

American Society of Mechanical Engineers—Lubrication Conference, sponsored jointly with American Society of Lubrication Engineers, Royal York Hotel, Toronto, Canada, Oct. 7-9; Power Conference, American Hotel, Allentown, Pennsylvania, Oct. 21-23.

National Electronics Conference, Inc—13th Annual Meeting Hotel Sherman, Chicago, Ill., Oct. 7-9.

American Institute of Electrical Engineers—Fall General Meeting, Morrison Hotel, Chicago, Ill., Oct. 7-11; Computers in Control Symposium, Hotel Claridge, Atlantic City, N. J., Oct. 16-18; 3rd Annual Farm Electrification Conference, Hotel Nicollet, Minneapolis, Minn., Oct. 29-31.

Electrical Association of Philadelphia—15th Electrical Progress Show, Convention Hall, Philadelphia, Pa., Oct. 8-10.

Canadian Electrical Manufacturers Association—13th Annual Meeting, Sheraton-Brock Hotel, Niagara Falls, Ontario, Canada, Oct. 9-11.

Southeastern Electric Exchange—Accounting Section, Fort Sumter Hotel, Charleston, S. C., Oct. 10-11; Sales Section, Tutwiler Hotel, Birmingham, Ala., Oct. 16-18.

Rocky Mountain Electric League—54th Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., Oct. 13-17.

Interstate Power Club—Hotel Martinique, New York City, N. Y., Oct. 14.

Pennsylvania State University—Electric Utility Company Managers Seminar, State College, Pa., Oct. 14-16.

American Society of Civil Engineers—Annual Meeting, Hotel Statler, New York City, Oct. 14-18.

Wisconsin Utilities Association—Electric & Gas Sales and Operating Sections Convention, Schroeder Hotel, Milwaukee, Wis., Oct. 16-18.

National Society of Professional Engineers—Fall Meeting, Grand Pacific Hotel, Bismarck, North Dakota, Oct. 17-19.

National Safety Congress—Conrad Hilton Hotel, Chicago, Ill., Oct. 21-25.

Engineers Council for Professional Development and Engineers Joint Council—General Assembly, Statler Hotel, New York City, Oct. 24-25.

Oklahoma Utilities Association—Electric Light and Power Division, Woodward, Okla., Oct. 25; Eastern District, Bartlesville, Okla., Oct. 25.

American Power Dispatchers Association, Inc—Fall National Meeting, Fresno, California, Oct. 25-26.

Atomic Industrial Forum—Annual Conference, New York City, Oct. 28-30.

American Nuclear Society—Winter Meeting, New York City, Oct. 28-30.

The University of Texas—10th Annual Power Distribution Conference, Austin, Texas, Oct. 28-30.

National Association of Railroad Utilities Commissioners—Annual Conference, Peabody Hotel, Memphis, Tenn., Oct. 28-31.

Industrial Management Society—21st Anniversary Industrial and Management Clinic, Hotel Sherman, Chicago, Ill., Oct. 30-Nov. 1.

Institute of Radio Engineers—3rd Annual Technical Conference of the Professional Group on Electron Devices, Shoreham Hotel, Washington, D. C., Oct. 31-Nov. 1.

NOVEMBER

• **American Institute of Mining, Metallurgical, and Petroleum Engineers**—Metals Division Fall Meeting, Morrison Hotel, Chicago, Ill., Nov. 3-7.

• **American Institute of Electrical Engineers**—Ninth Annual Machine Tool Conference, Hotel Schroeder, Milwaukee, Wis., Nov. 4-6.

Edison Electric Institute—Accident Prevention Committee, Penn-Sheraton Hotel, Pittsburgh, Pa., Nov. 6-8; Southern Region Home Service Workshop, Atlanta, Ga., Nov. 12-13; Accounting Division Advisory and Executive Committees, The Cloisters, Sea Island, Ga., Nov. 14-15.

Pacific Coast Electrical Association—Hawaiian Conference, Reef Hotel, Honolulu, Hawaii, Nov. 7-8.

• **Pennsylvania Electric Association**—Prime Movers Committee, Bedford Springs Hotel, Bedford, Pa., Nov. 7-8; System Planning Committee, Van Curler Hotel, Schenectady, N. Y., Nov. 7-8; Electrical Equipment Committee, Ben Franklin Hotel, Philadelphia, Pa., Nov. 14-15.

Institute of Radio Engineers—Third Annual Instrumentation Conference, Atlanta Biltmore Hotel, Atlanta, Georgia, Nov. 11-13.

National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., Nov. 11-15.

• Additions this week.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

DISPLAYED RATE:

EMPLOYMENT OPPORTUNITIES: $19.15 per inch. Subject to Agency Commission.
EQUIPMENT & BUSINESS OPPORTUNITIES: $14.00 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

UNDISPLAYED RATE:

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

SEND NEW ADVERTISEMENTS TO Classified Advertising Div. of ELECTRICAL WORLD, P. O. Box 12, N. Y. 36, N. Y.

This Searchlight Section

of ELECTRICAL WORLD

is an index of reliable sources for Used and Resale electrical equipment now available. Consult the *Searchlight Section* in following issues for later offerings.

If you don't see what you want—ask for it. Ask the advertisers. Dealers are constantly adding to their stocks and may have acquired just what you need.

And, when you have special items to dispose of, dealers will be glad to know of it, or you can use this Searchlight Section to contact user-buyers direct, if you prefer. Send a list of your equipment and we will gladly give full space and rate information.

Write

Classified Advertising Division

P. O. Box 12

ELECTRICAL WORLD

330 W. 42nd St.

New York 36, N. Y.

LARGE POWER EQUIPMENT

Prompt Stock Shipment

REBUILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?

BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
DL. 3-3334

Bids: Nov. 15, 1957.

Sealed bids will be received in the office of the Engineering and Construction Director, Panama Canal Company, Balboa Heights, Canal Zone, until 1:00 P.M. November 15, 1957 and at that time publicly opened, for the material and work required to furnish and install a coordinated system of remote supervisory control, telemetering equipment, protective relaying equipment, and other appurtenant material for the Canal Zone power facilities. Plans and specifications are available for examination in the office of Chief, Procurement Division, Panama Canal Co., 21 West St., New York 6, N. Y. Data may be obtained upon payment of $50.00 deposit which will be refunded when data is returned within 40 calendar days after bid opening. For further information contact this office, Desk No. 1, or telephone Bowling Green 9-5380, extension 56.

REPLIES (Box No.): Address to office nearest you
c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION VACANT

Position Available: Middle Atlantic State. Graduate Electrical Engineer as Superintendent with intimate knowledge of Generation, Distribution, and Metering. Municipal, 20,000 pop. Steam. Furnish resume and salary requirement. P-5989, Electrical World.

When Answering

BOX NUMBERS...

to expedite the handling of your correspondence and avoid confusion, please do not address a single reply to more than one individual box number. Be sure to address separate replies for each advertisement.

CHIEF ELECTRICAL ENGINEER

Planning & supervision of electrical design of steam-electric stations, substations and transmission lines. Sound background and flexible personality essential for client contact. 35-50 years. Location Chicago. Long range opportunity with established, reputable engineering-construction firm. Please send confidential resume.

P-6093, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER

Electrical Engineer interested in electrical design of power plants or industrial plants. Experience not required.

Excellent opportunity with consulting engineering firm in Middle West. Liberal benefit plans and good working conditions.

Send resume of education and experience with statement of salary requirements to:

P-3234, Electrical World,
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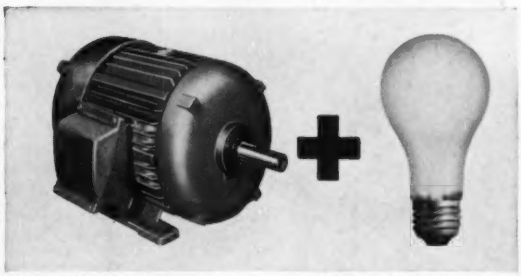

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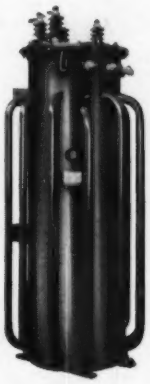

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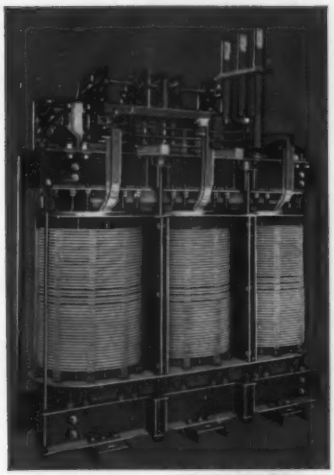

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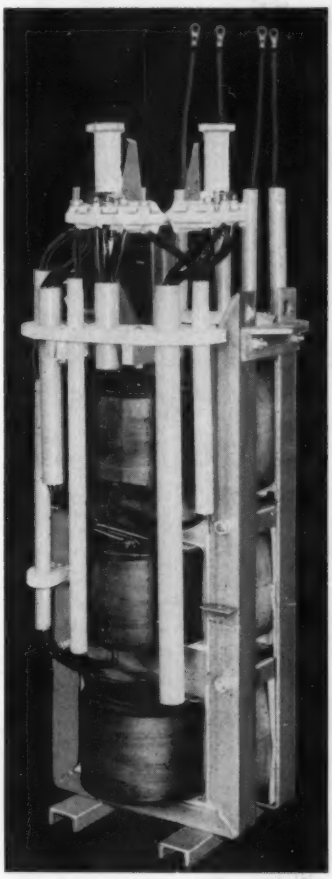

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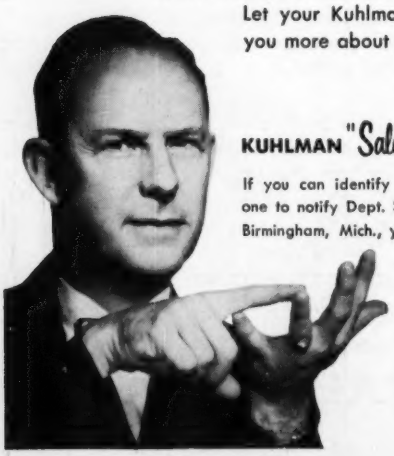

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